

SYNOPSIS OF

SURGICAL ANATOMY

&

GUIDE TO SPOTTING EXAMS

BY

DR. SAMEH DOSS (Ph.D)

PROFESSOR OF ANATOMY

FACULTY OF MEDICINE , CAIRO UNIVERSITY

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رقم الأيداع بدار الكتب ١٩٩٦/٧٣٦٩

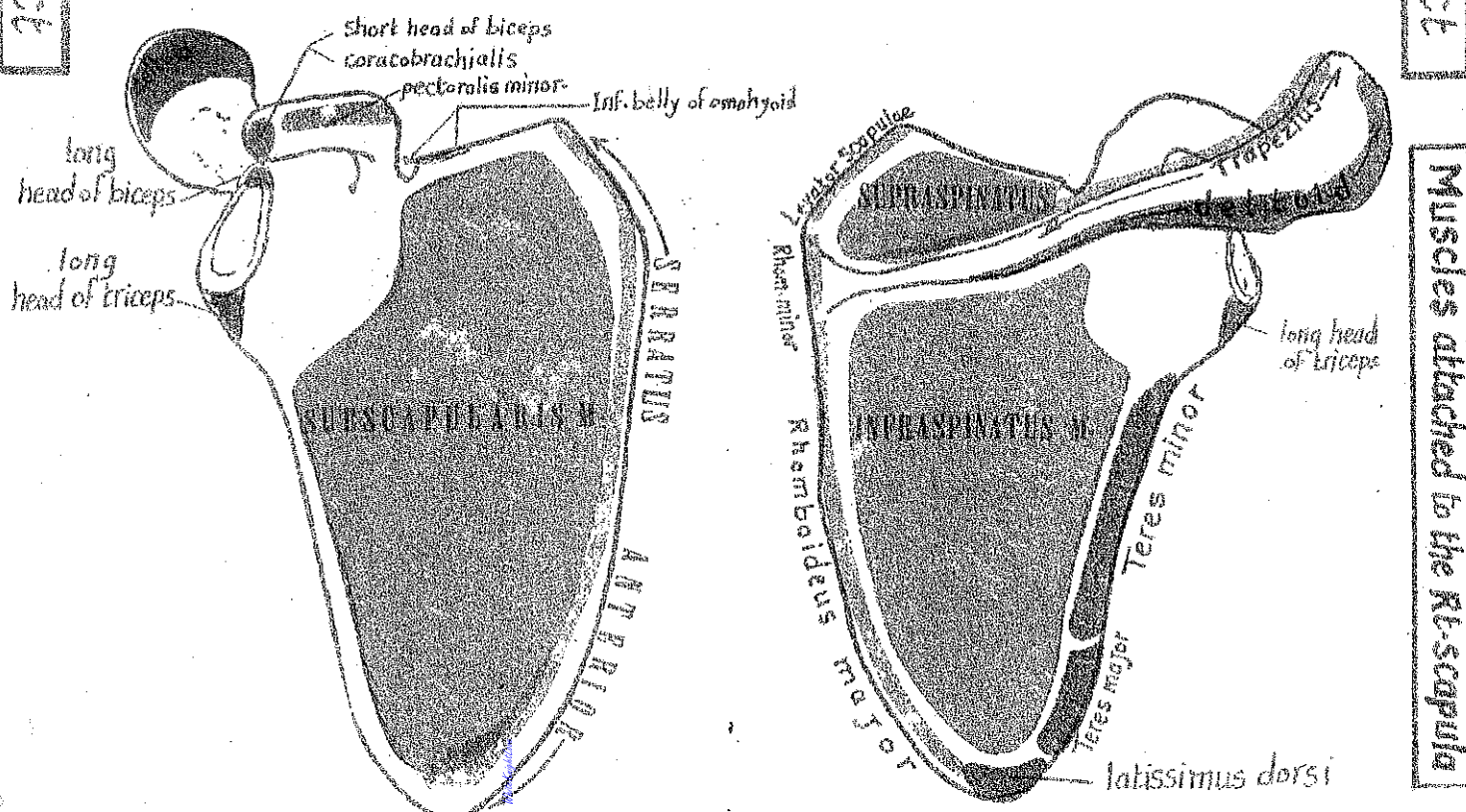
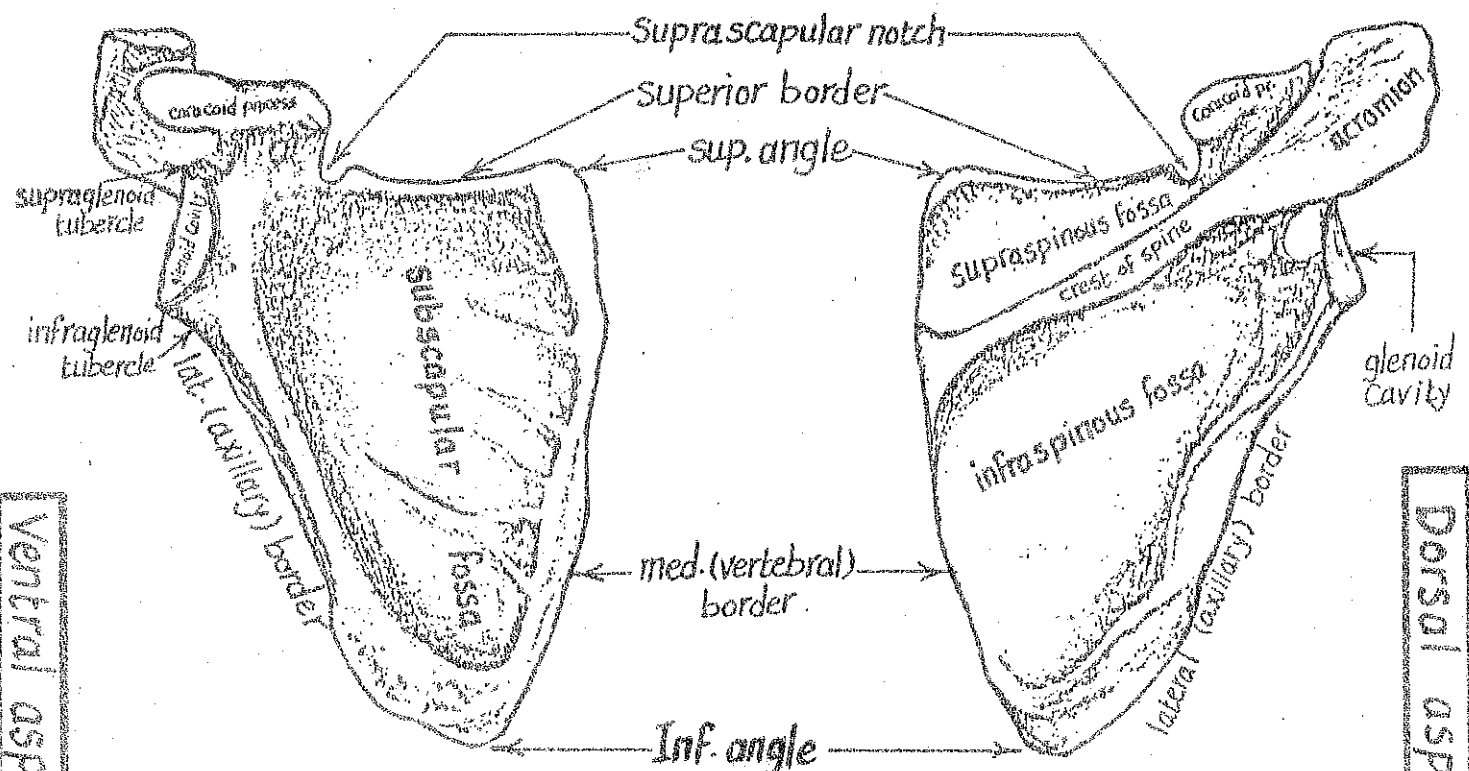
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THE SCAPULA

2

FEATURES is a flat bone having:

- (A) 2 surfaces : (1) ventral (forming subscapular fossa) (2) dorsal : presenting the spine.
- (B) 3 borders : (1) upper (shortest) (2) medial (longest) (3) lateral (thickest).
- (C) 3 angles : (1) sup. (level of 2nd rib) (2) inf. (level of 7th rib) (3) lat. (glenoid cavity).
- (d) 3 fossae : (1) subscapular (ventrally) (2) supraspinous (3) infraspinous.
- (e) 3 processes : (1) spine (2) acromion (3) coracoid process.



THE HUMERUS

3

FEATURES

I- upper end : consists of:

- (1) head : articulates with the glenoid cavity.
- (2) 2 necks :
 - anatomical neck
 - surgical neck
 - greater : carrying 3 muscular facets.
 - lesser : " 1 " facet.
- (3) bicipital groove having med.-lip, lat.-lip & floor

II- Shaft : has:

- 3 borders
 - ant.
 - med: ends by med. supracondylar ridge.
 - lat: " " lat. " " "
- 3 surfaces : anteromedial, anterolateral & posterior.
- surface presenting the spiral groove

III- Lower end : consists of:

- (1) trochlea : for articulation with ulna
- (2) capitulum : for articulation with radius
- (3) med. epicondyle : more prominent.
- (3) lat. epicondyle : less
- (4) 3 fossae : olecranon (post.), radial & coronoid (ant.)

SURGICAL IMPORTANCE

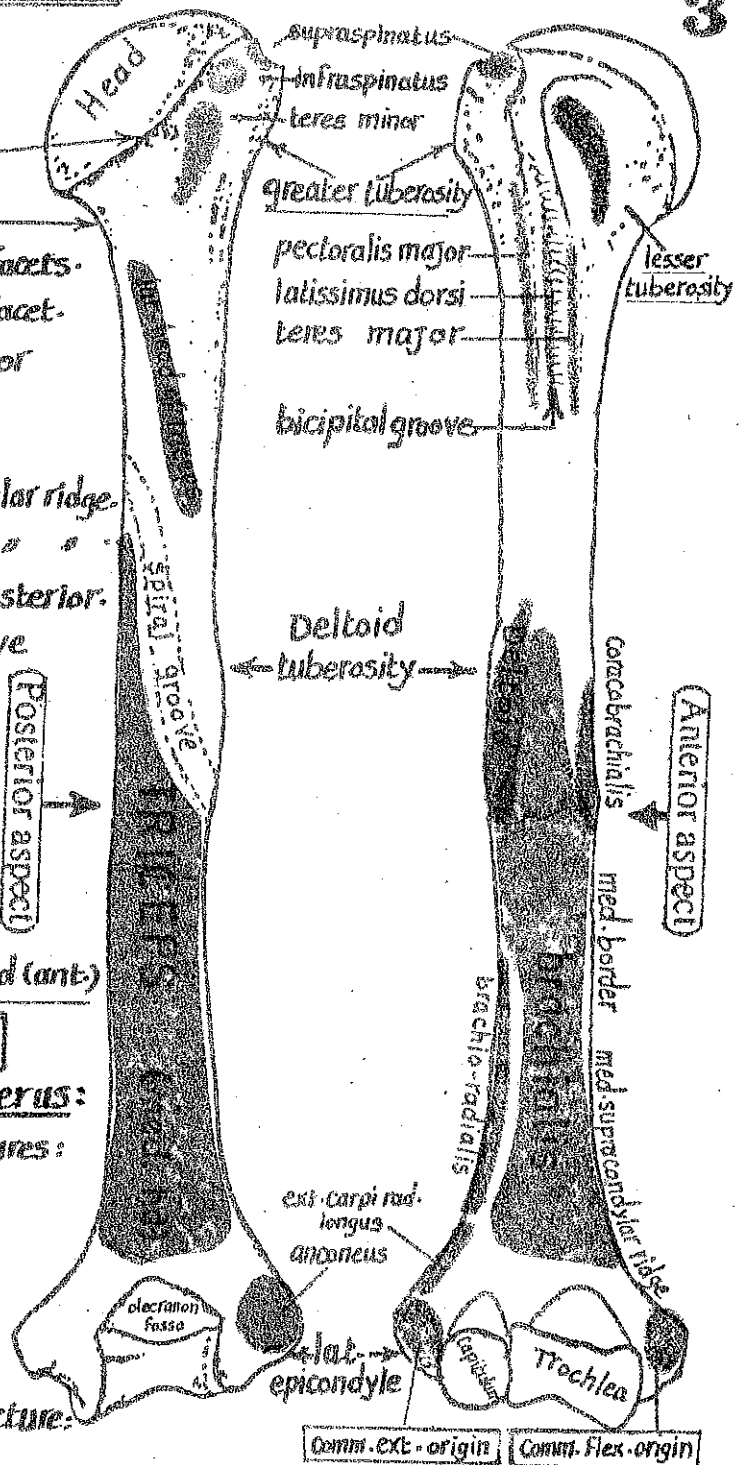
A) 3 nerves are directly related to the humerus:

and are, therefore, liable to injury in fractures:

- (1) axillary n. : around the surgical neck.
- (2) radial n. : in the spiral groove.
- (3) ulnar n. : behind the med. epicondyle.

B) In fracture of humeral shaft the resulting

displacement depends on the site of the fracture:

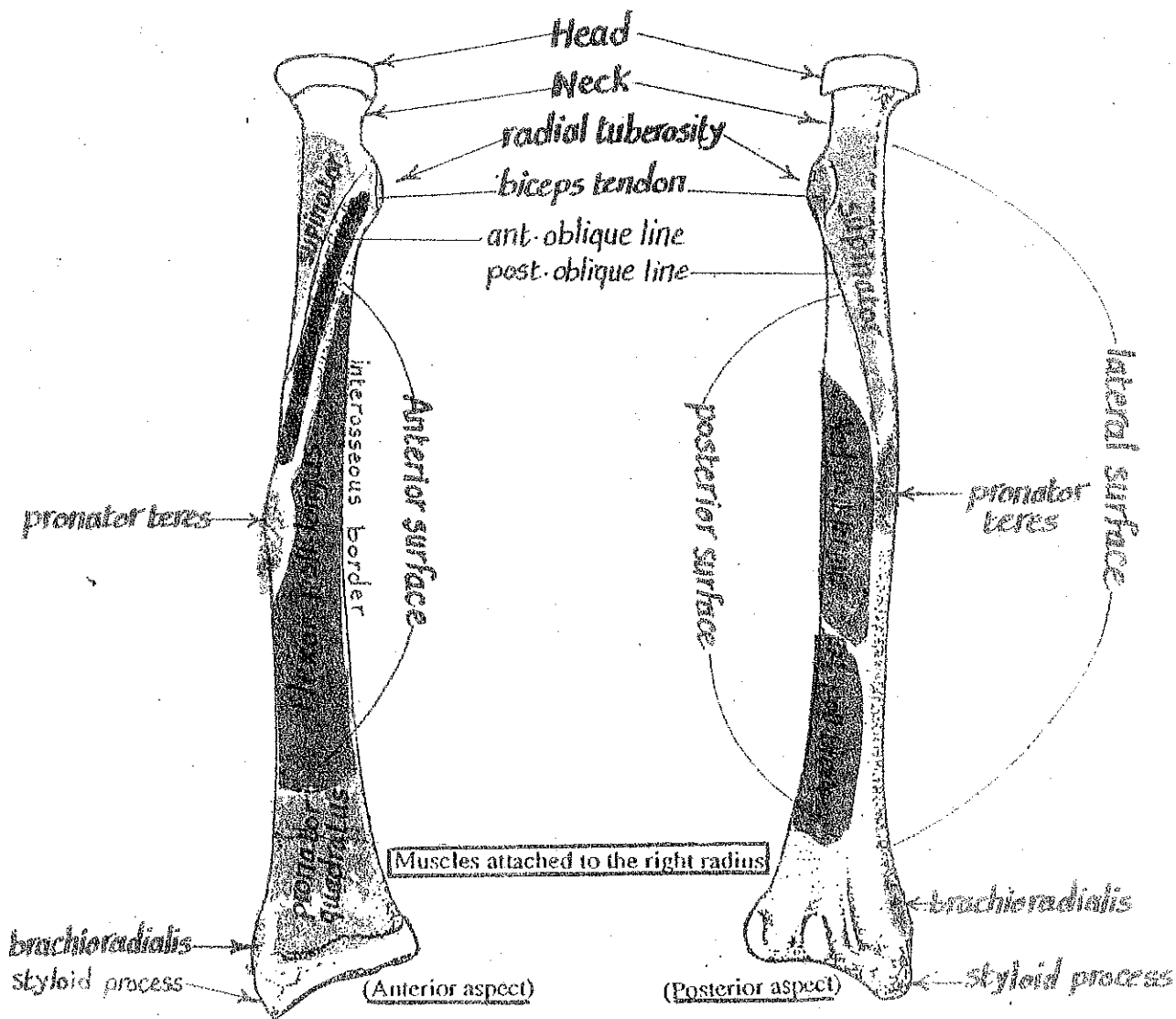


Site of fracture	Proximal fragment	Distal fragment	X-ray
(1) Surgical Neck (above bicipital groove)	abducted by the muscles attached to greater tuberos (mainly supraspinatus).	adducted by the muscles attached to the bicipital groove	
(2) Above the level of deltoid tuberosity	adducted by the muscles attached to bicipital groove.	abducted & pulled up by deltoid	
(3) Below the level of Deltoid tuberosity	Abducted by deltoid	adducted & pulled up by biceps & triceps	

C) Surgical exposure of humerus: upper 1/3 : incision along deltopectoral groove lower 2/3 : " " the med. or lat. intermuscular septum.

THE RADIUS

4

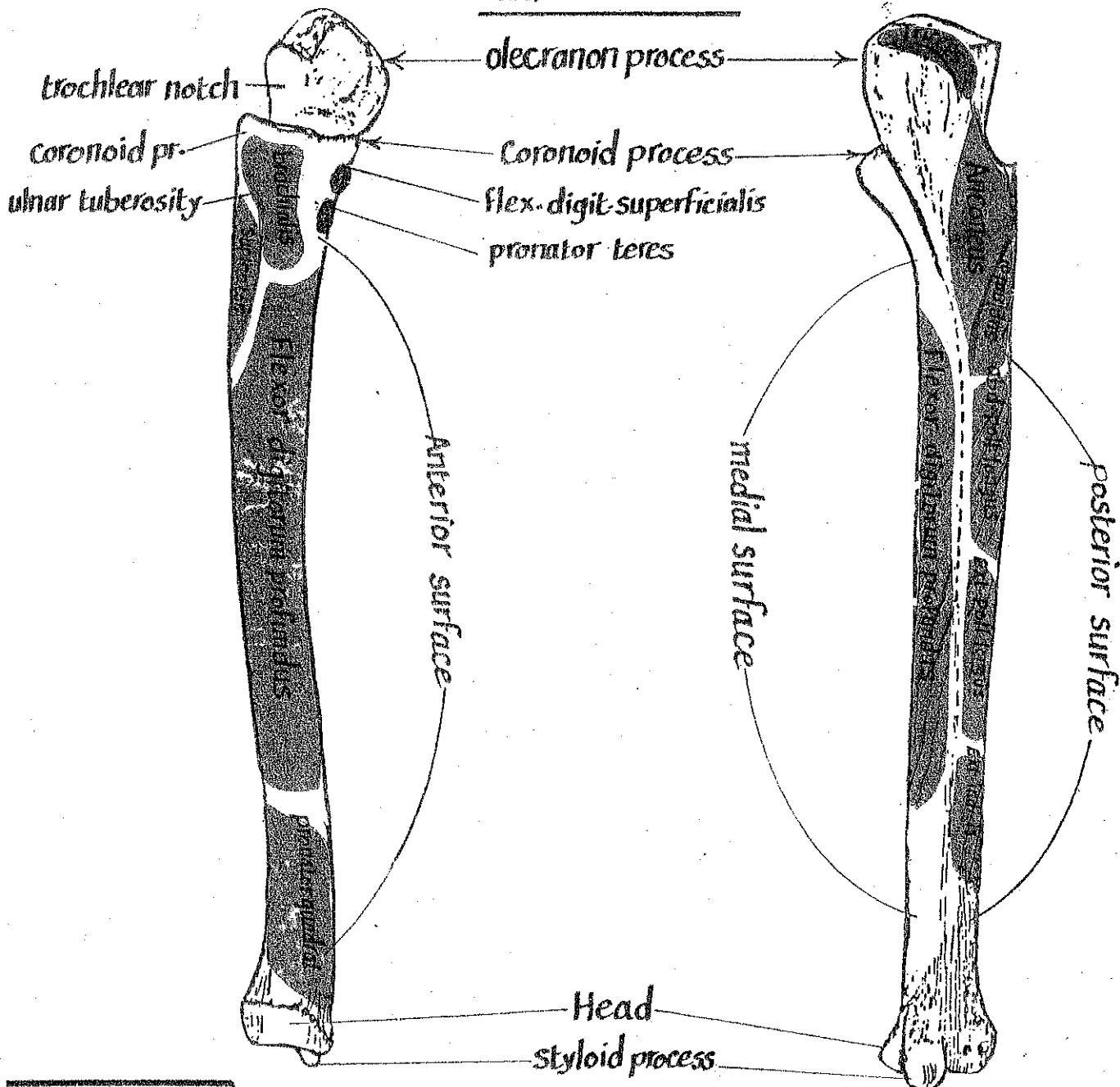


GENERAL FEATURES

- (A) Upper end: consists of: (1) head (2) neck (3) radial tuberosity
- (B) Shaft: has 3 surfaces (ant., post. & lat.) separated by 3 borders
 ↗ ant
 ↘ interosseous
 ↗ post
- (C) Lower end: expanded & presents: (1) styloid process laterally (2) ulnar notch (medially) (3) articular surface (below).

- (1) Surgical exposure of radius is done by an incision along the ant. border of brachioradialis.
- (2) In Fracture radius, Fixation of the forearm depends on the site of the fracture as follows:
 - (a) Above the insertion of pronator teres: the proximal fragment is supinated by biceps & supinator m. so, fixation of the forearm is done in the Supine position.
 - (b) below the insertion of pronator teres: the proximal fragment is midpronated by the combined action of biceps, supinator & pronator teres, So, Fixation is done in the midprone position.
- (c) Fracture of the lower end (Colles fracture): the proximal fragment is pronated by the spasm of pronator quadratus m. So, Fixation is done in the prone position.

THE ULNA



FEATURES :

A- upper end : shows:
 2 processes (olecranon & coronoid)
 2 notches (trochlear & radial)
 2 muscular impressions (ulnar tuberosity & supinator fossa).

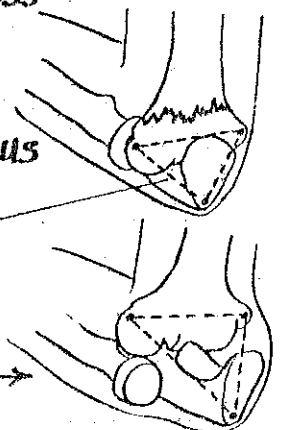
B- Shaft : has 3 surfaces (ant., post. & med.) separated by 3 borders (ant., post. & interosseous).

C- lower end : presents a small rounded head & a blunt styloid process.

SURGICAL IMPORTANCE

(1) Surgical exposure of ulna is done by an incision along its subcutaneous post. border.

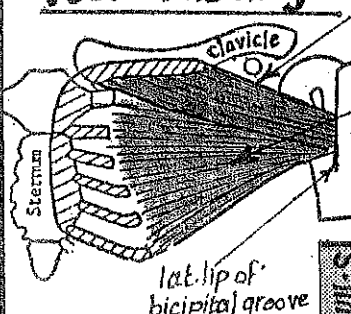
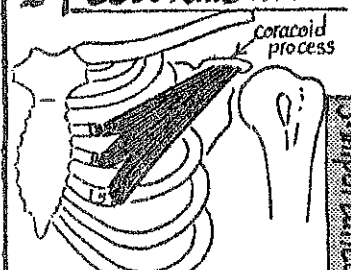
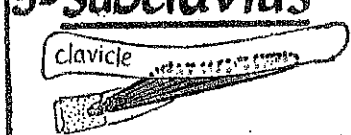
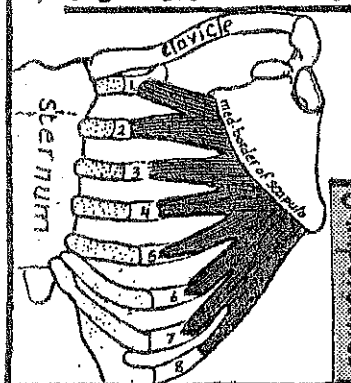
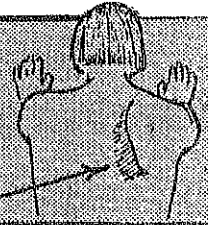
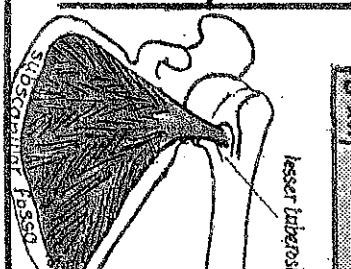
(2) the tip of the olecranon process forms an equilateral triangle with the 2 humeral epicondyles in the normal elbow & also in the supracondylar fracture. In dislocated elbow this Δ is no longer equilateral →

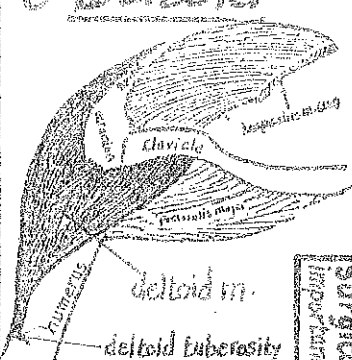
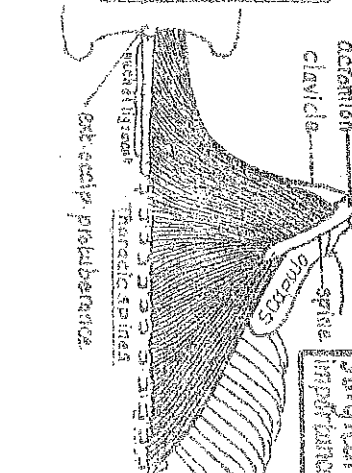
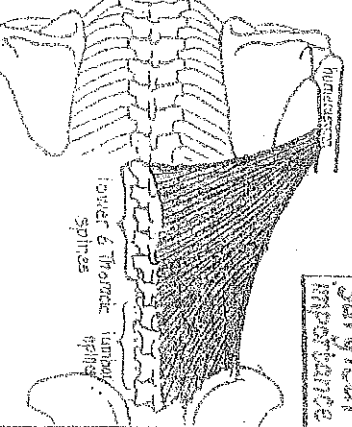
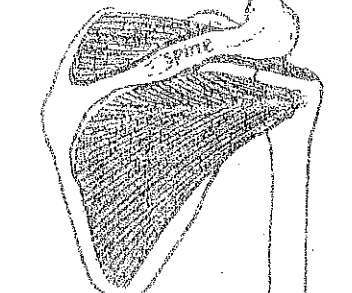


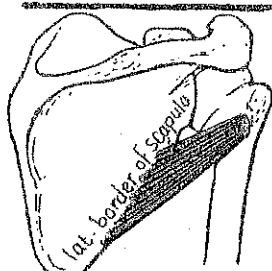
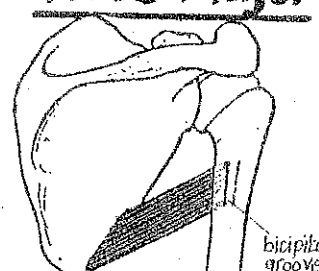
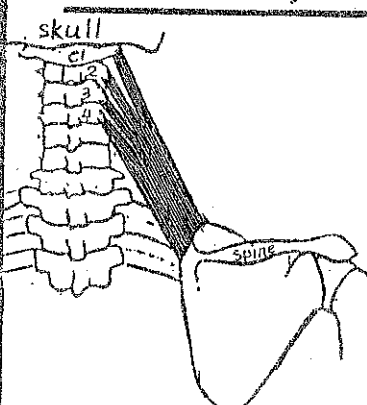
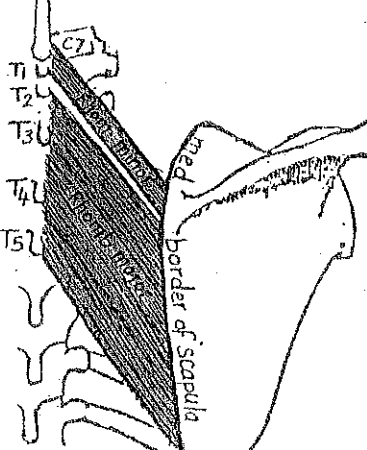
MUSCLES OF THE U.L

6

MUSCLES OF THE SHOULDER REGION

MUSCLE	ORIGIN	INSERTION	N.S	ACTION
1-Pectoralis major 	(1) Clavicular head: med. 1/2 of front of clavicle (2) Sternocostal head: - ant. surface of sternum. - upper 6 costal cartilages. - ext. abd. oblique aponeurosis.	lat. lip of the bicipital groove of humerus	Med & lat. pectoral n.	(1) the whole muscle: adducts & rotates the arm medially. (2) Clavicular head: flexes the extended arm. (3) Sternocostal head: extends the flexed arm.
S-Importance	(1) in radical mastectomy: the sternocostal head is removed & the clavicular head is preserved (to protect the cephalic v. & to prevent infraclavicular hollowness). (2) in modified radical mastectomy: the whole muscle is preserved & only the pectoral fascia is removed (as it contains lymphatics from the breast to the axillary L.Ns).			
2-pectoralis minor 	3rd, 4th & 5th ribs.	Coracoid process of scapula.	Med. pect.	draws the scapula downwards & forwards
S-Importance	(1) it should be removed in radical mastectomy to open the axilla (2) it divides the axillary a. into 3 parts (see page 17). (3) it divides the axillary L.Ns into 3 levels (see page 29).			
3-subclavius 	First Costo-Chondral Junction.	subclavian groove of clavicle	N-to subclavius	steadies the clavicle during movements of the shoulder joint.
4-Serratus ant. 	by 8 digitations from the outer surface of upper 8 ribs	ventral aspect of med. border of scapula	N-to serratus ant. (long thoracic N.)	(1) protraction of scapula (2) upward rotation " (3) fixation of the scapula to the chest wall
S-Importance	(1) the n-to serratus should be preserved during radical mastectomy (it runs on the outer surface of the muscle in the midaxillary line). (2) Injury of this n. leads to Winging of the scapula. 			
5-Subscapularis 	subscapular fossa of scapula	lesser tuberosity of humerus	upper & lower subscapular n.	adduction & med. rotation of arm.
S-Importance	(1) in reduction of shoulder dislocation, the spasmed subscapularis m. should be tired by applying external rotation on the arm (Kocher's method). (2) in recurrent dislocation, the subscapularis tendon should be shortened by double breast operation to limit abduction & ext. rotation (Putti-platt operation).			

MUSCLE	ORIGIN	INSERTION	N.S	ACTION
6-Deltoid 	V-Shaped origin from: (1) ant. border of lat. $\frac{1}{3}$ of the <u>clavicle</u> . (2) lat. border of <u>acromion</u> . (3) lower lip of <u>spine of scapula</u> .	Deltoid tuberosity of the humerus	Axillary (circumflex)	(1) Ant. fibres: flexion & med. rotation of arm. (2) middle fibres: abduction of the arm (from 15° to 90°). (3) post. fibres: extend & laterally rotate the arm
Surgical importance injury of axillary n. $\rightarrow$ paralysis of deltoid manifested by: (1) failure of abduction from 15° to 90° (2) Flat shoulder deformity.				
7-Trapezius 	(1) Back of head: ext. occipital protuberance + sup. nuchal line (2) Back of neck: nuchal lig. & spine of C7 (3) Back of thorax: all thoracic spines & supra spinous lig.	V-Shaped in: (1) post. border of the lat. $\frac{1}{3}$ of <u>clavicle</u> . (2) med. border of <u>acromion</u> . (3) upper lip of the spine of <u>scapula</u> .	Spinal accessory n. + C3, 4	- <u>upper fibres</u> : elevate the scapula - <u>middle fibres</u> : retract the scapula. - <u>lower fibres</u> : rotate the glenoid cavity upwards (aided by the lower fibres).
Surgical importance (1) it is the only muscle in the U.L. which is Not supplied by brachial plexus. (2) its paralysis leads to shoulder drop.				
8-Latissimus Dorsi 	- lower 6 thoracic spines. - thoraco-lumbar fascia. - lower 3 or 4 ribs. - inferior angle of scapula. - post. part of iliac crest.	Floor of bicipital groove of the humerus.	N. latissimus dorsi	(1) Extension, adduction & med. rotation of arm (2) used in climbing & swimming.
Surgical importance its nerve can be sacrificed during the operation of radical mastectomy without bad effects.				
(9) Supraspinatus 	supraspinous fossa of scapula.	uppermost facet of greater tuberosity of humerus.	Suprascapular n.	(1) abduction of arm (from 0° to 15°). (2) Stabilization of shoulder joint
(10) Infraspinatus	infraspinous fossa of scapula.	middle facet of greater tuberosity.		(1) lat. rotation of arm (2) stabilization of shoulder joint

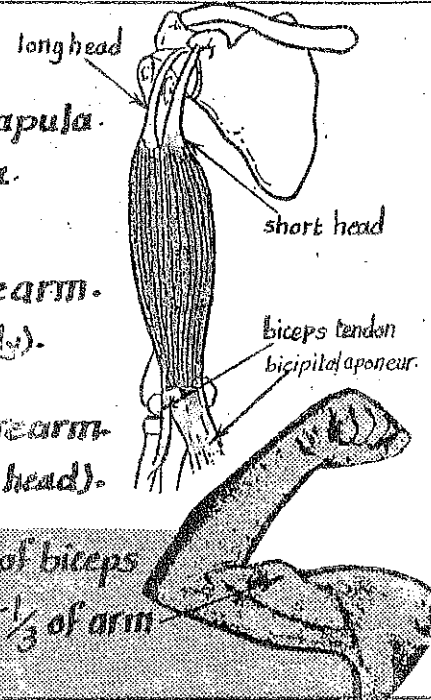
MUSCLE	ORIGIN	INSERTION	N.S	ACTION
11-Teres Minor 	upper 2/3 of dorsal aspect of lat. border of scapula.	lowermost facet of greater tuberosity of humerus.	Axillary n.	adduction & Lat. rotation of the shoulder.
12-Teres Major 	lower 1/3 of dorsal aspect of lat. border of scapula. <i>- it is an important landmark: its lower border is the lower limit of the axilla (the axillary a. ends & brachial a. begins)</i>	Med. lip of bicipital groove of humerus.	Lower subscapular n.	Extension, adduction & med. rotation of shoulder
13-Levator Scapulae 	transverse processes of the upper 4 cervical vertebrae.	med. border of scapula from the sup. angle to the root of the spine.	Nerve to Rhomboids	-elevates scapula & rotates the glenoid cavity downwards.
14-Rhomboid Minor 	7 th cervical & 1 st thoracic spines.	med. border of scapula opposite the root of the spine.		- Retract the scapula & rotate the glenoid cavity downwards
15-Rhomboid Major	2 nd , 3 rd , 4 th & 5 th thoracic spines.	med. border of scapula from the root of spine to the inferior angle.		

MUSCLES OF THE ARM

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- * The front of arm contains 3 flexor muscles
 - ① biceps brachii
 - ② coracobrachialis
 - ③ brachialis m.
- * The back " " " " one extensor m. — ④ Triceps m.

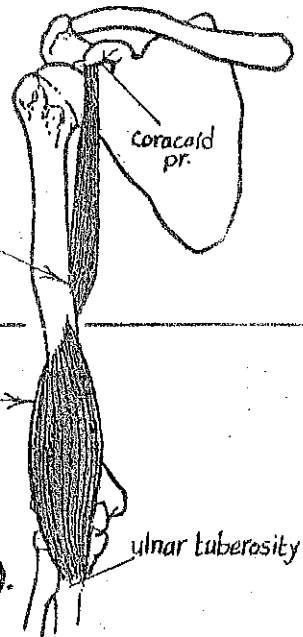
1- Biceps brachii



- * Origin : (1) long head : from supraglenoid tubercle of scapula.
(2) short " : from coracoid process of scapula.
- * Insertion : (1) biceps tendon : into radial tuberosity.
(2) bicipital aponeurosis : into deep fascia of forearm.
- * N. supply : musculocutaneous n. (each head is supplied separately).
- * Action : (1) Flexion of elbow (2) supination of the flexed forearm.
(3) it also helps stabilization of shoulder joint (long head).

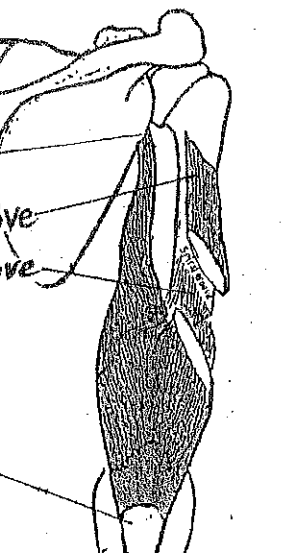
SURGICAL IMPORTANCE rupture of the tendon of long head of biceps (as a result of heavy weight lifting) produces a lump in the lower $\frac{1}{3}$ of arm on flexion of elbow.

2- Coracobrachialis



- * Origin : Coracoid process (in common with short head of biceps).
- * Insertion : middle of the medial border of humerus.
- * N. supply : musculocutaneous n. (pierces the muscle).
- * Action : weak flexor & adductor of shoulder joint.

3- Brachialis



- * Origin : lower $\frac{1}{2}$ of front of humerus + med. & lat. intermuscular septa.
- * Insertion : ulnar tuberosity
- * N. Supply : musculocutaneous & radial nn. (double n. supply).
- * Action : Main flexor of elbow.

4- Triceps m.

- * Origin : (1) long head : infraglenoid tubercle of scapula.
(2) lat. head : post. surface of humerus above spiral groove
(3) med. head : " " " " below spiral groove
- * Insertion : olecranon process of ulna
- * N. supply : Radial n.
- * Action : Main extensor of the elbow.

Muscles of Front of Forearm (Flexors)

General remarks

a. Superficial group : 5 muscles

- (1) pronator teres.
- (2) flexor carpi radialis
- (3) palmaris longus
- (4) flex. digit. superficialis
- (5) flexor carpi ulnaris.

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(1) Origin: all arise from the front of med. epicondyle : C.F.O.

(Common flexor origin). Some of them have additional origins.

(2) Insertion: all are inserted in the hand except pronator teres (in the radius).

(3) N. supply: all supplied by median n. except fl. carpi ulnaris (by ulnar n.)

(4) Action: all flex the elbow. Each one has a specific action (indicated by its name)

1- Pronator teres

* Origin: (1) humeral head: C.F.O. (2) ulnar head: coronoid pr. of ulna

* Insertion: pronator tuberosity of radius.

* N. supply: median n. (passes between its 2 heads).

* Action: (1) pronation of forearm (2) helps flexion of elbow.

Surgical imp.: median n. may be compressed between its 2 heads (by post-traumatic fibrosis)

2- Flexor Carpi radialis

* Origin: C.F.O.

* Insertion: bases of the 2nd & 3rd metacarpal bones.

* N. supply: median n.

* Action: (1) flexion of elbow (2) flexion & abduction of the wrist.

3- Palmaris longus (may be absent)

* Origin: C.F.O.

* Insertion: apex of palmar aponeurosis.

* N. supply: median n.

* Action: flexes wrist & tightens palmar

Surgical imp.: its tendon can be used as a tendon graft.

4- Flexor digitorum Superficialis

* Origin: (1) humero-ulnar head: C.F.O. & coronoid process of ulna.

(2) Radial head: from ant. oblique line of radius.

* Insertion: by 4 tendons into sides of middle phalanges of the med. 4 fingers.

* N. supply: median n. (adherent to its deep surface).

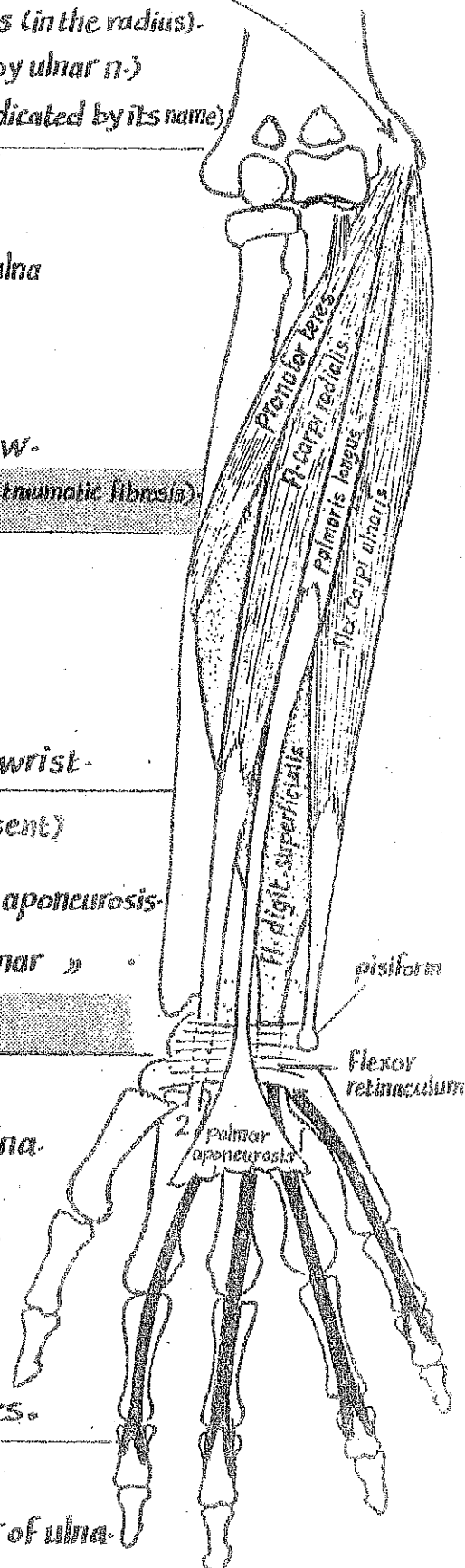
* Action: flexion of: elbow, wrist, M.P. & proximal I.P. joints.

5- Flexor Carpi ulnaris

* Origin: (1) Humeral head: C.F.O. (2) ulnar head: post. border of ulna.

* Insertion: pisiform bone & base of 5th metacarpal bone.

* N. supply: ulnar n. * Action: flexion of elbow, flexion & adduction of wrist.



B-

THE DEEP GROUP OF MUSCLES OF THE FRONT OF THE FOREARM

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1- Flexor Pollicis longus

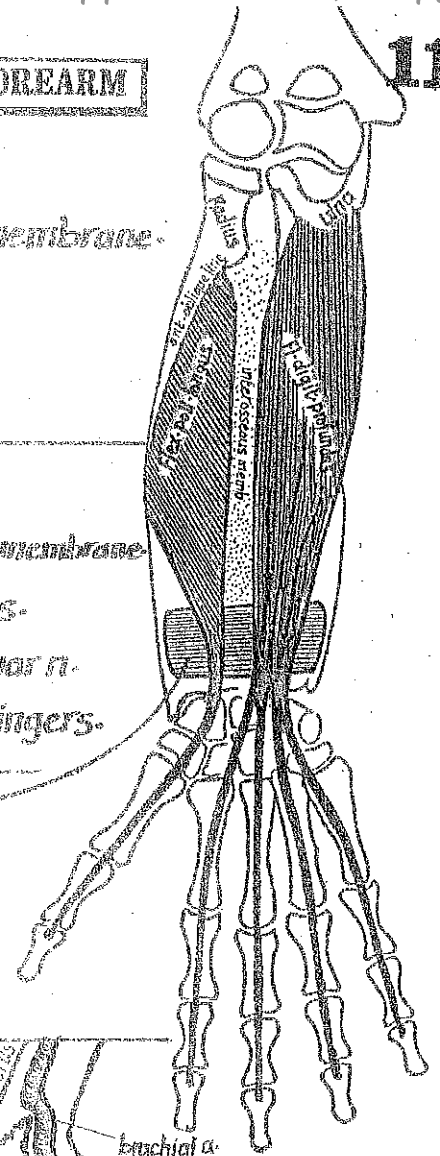
- * Origin: upper 2/3 of ant. surface of radius + the interosseous membrane.
- * Insertion: base of terminal phalanx of the thumb.
- * N. Supply: ant. interosseous n. (branch of median n.).
- * Action: (1) flexion of wrist. (2) flexion of all joints of the thumb.

2- Flexor digitorum profundus

- * Origin: upper 2/3 of ant. & med. surfaces of ulna + the interosseous membrane.
- * Insertion: 4 tendons into terminal phalanges of the med. 4 fingers.
- * N. Supply: (1) lat. 1/2: supplied by ant. interosseous n. (2) med. 1/2: by ulnar n.
- * Action: (1) flexion of wrist. (2) flexion of all joints of the med. 4 fingers.

3- Pronator Quadratus

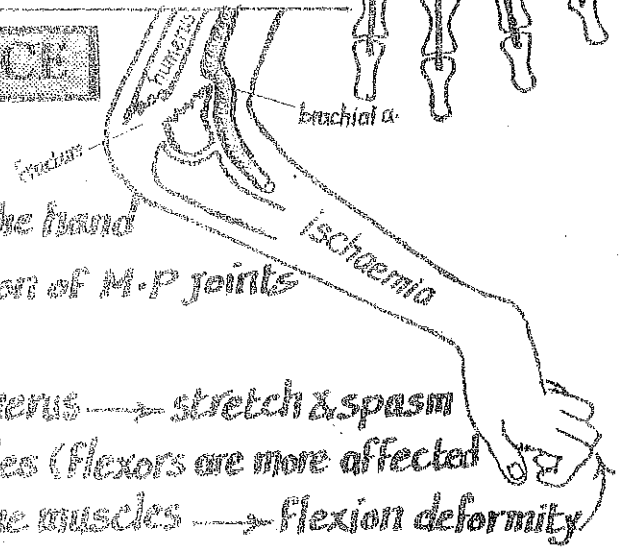
- * Origin: lower 1/4 of ant. surface of ulna.
- * Insertion: lower 1/4 of ant. surface of radius.
- * N. Supply: ant. interosseous n. * Action: pronation.



SURGICAL IMPORTANCE

* Volkmann's ischaemic contracture:

- definition: it is a flexion deformity affecting the hand characterized by flexion of wrist, hyperextension of M-P joints & flexion of the I-P joints.
- Pathogenesis: supracondylar fracture of humerus → stretch & spasm of brachial a. → ischaemia of forearm muscles (flexors are more affected than extensors) → fibrosis & shortening of the muscles → flexion deformity



Muscles of Back of Forearm (Extensors)

a. Superficial group

- they include 7 muscles: arranged from lat to med. as follows:
- the muscles number 1, 2 & 7 have different sites of origins & are supplied by the radial n.
- the remaining 4 muscles arise from the front of the lat. epicondyle (Common Extensor origin "C-E-O") & are supplied by the post. interosseous n. (br. of radial n.).
- Common action: all are extensors of wrist except brachioradialis & anconeus.

- (1) brachioradialis.
- (2) Ext. carpi radialis longus.
- (3) " " " " brevis.
- (4) extensor digitorum.
- (5) " " digiti minimi.
- (6) " " carpi ulnaris.
- (7) anconeus.

1-Brachio-radialis

- * Origin: upper 2/3 of lat. supracondylar ridge of humerus.
- * Insertion: base of the styloid process of radius.
- * N. Supply: Radial n.
- * Action: (1) initiates pronation & supination.
(2) flexes the midprone forearm.

2-Extensor Carpi radialis longus

- * Origin: lower 1/3 of lat. supracondylar ridge.
- * Insertion: base of 2nd metacarpal bone (dorsal aspect).
- * N. Supply: radial n.
- * Action: extension & abduction (radial deviation) of wrist.

3-Extensor Carpi radialis brevis

- * Origin: C-E-O
- * Insertion: base of 3rd metacarpal bone
- * N. supply: post. Interosseous n.
- * Action: extension & abduction of wrist

4-Extensor digitorum

- * Origin: C-E-O
- * Insertion: by 4 tendons into extensor expansions of the med. 4 fingers.
- * N. Supply: post. interosseous n.
- * Action: (1) extension of wrist (2) extension of the med. 4 fingers

5-Extensor digiti minimi

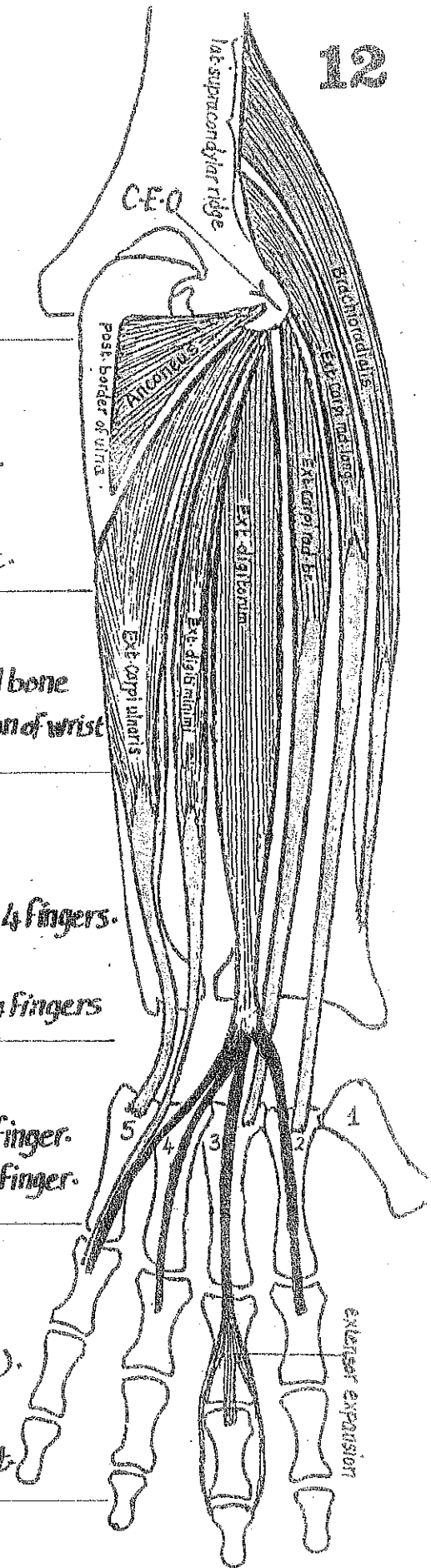
- * Origin: C-E-O
- * Insertion: extensor expansion of little finger.
- * N. supply: post. interosseous n.
- * Action: extension of little finger.

6-Extensor Carpi ulnaris

- * Origin: (1) C-E-O (2) post. border of ulna
- * Insertion: base of 5th metacarpal bone (dorsal aspect).
- * N. Supply: post. interosseous n.
- * Action: extension & adduction (ulnar deviation) of wrist.

7-Anconeus

- * Origin: back of the lat. epicondyle of humerus.
- * Insertion: upper 1/4 of post. border of ulna + lat. surface of olecranon process.
- * N. supply: Radial n.
- * Action: extension of elbow joint.



B. Deep group

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* They include the following 5 muscles which are all supplied by the post. interosseous nerve.

1- Supinator

- * Origin: supinator fossa & crest of ulna.
- * Insertion: upper $\frac{1}{3}$ of ant., lat. & post. surfaces of radius.
- * Action: supination of the extended forearm.

2- Abductor pollicis longus

- * Origin: post. surfaces of radius, ulna & the interosseous membrane.
- * Insertion: base of the 1st metacarpal bone.
- * Action: (1) abducts the thumb (2) can extend the thumb.
- N.B.: it can flex the wrist when the wrist flexors are paralysed.

3- Extensor pollicis brevis

- * Origin: post. surface of radius + interosseous membrane.
- * Insertion: base of the proximal phalanx of the thumb.
- * Action: extension of " " " " " "

4- Extensor pollicis longus

- * Origin: post. surface of ulna + interosseous membrane.
- * Insertion: base of terminal phalanx of the thumb.
- * Action: extension of all joints of the thumb.

5- Extensor indicis

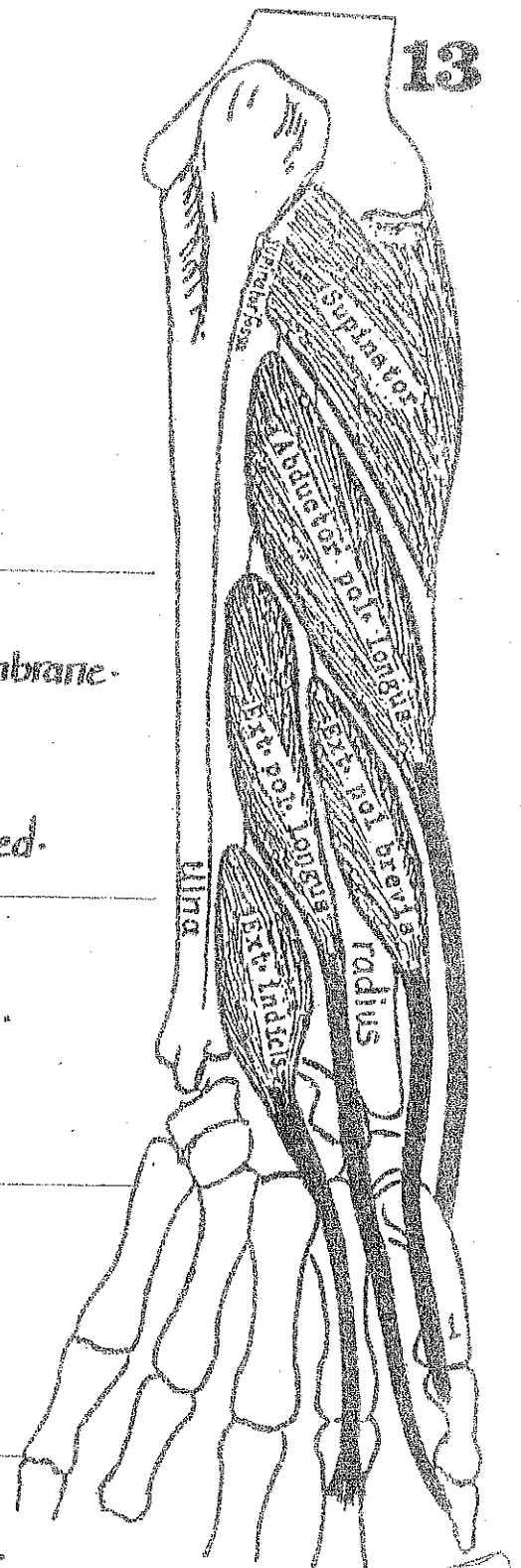
- * Origin: back of lower part of ulna + interosseous membrane.
- * Insertion: extensor expansion of index finger.
- * Action: extension of index finger.

Anatomical Snuff-box

* It is a triangular depression on the posterolateral aspect of the wrist

- * Boundaries:
 - medially: extensor pollicis longus tendon
 - laterally: abd. pollicis longus & ext. pol. brevis tendons
- * Floor: scaphoid bone
- * Contents: radial artery (its pulsations can be felt).

SURGICAL IMPORTANCE: fracture scaphoid $\rightarrow$ swelling & tenderness in the anatomical snuff-box.



radial a.

anatomical snuff-box

MUSCLES OF THE HAND

14

(A) Muscles of the intermediate Compartment :

I- Interosseous muscles : Fill the spaces between the metacarpal bones. All are supplied by ulnar n. They include :

- 4 palmar interossei : adduct the fingers.
- 4 dorsal " : abduct the fingers.

II- Lumbrical muscles : arise from fl. digit. profundus tendons.

- action : putting the fingers in the writing position.
- N. supply : the lat. 2 : median n.
the med. 2 : ulnar n.

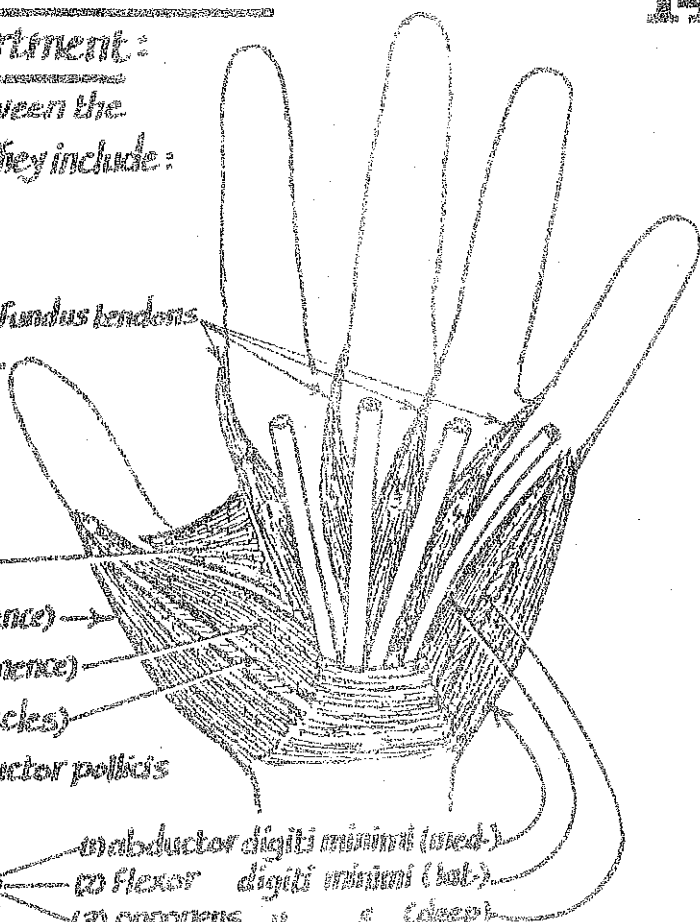
(B) Muscles of the thenar eminence (4) :

- (1) adductor pollicis (1st web muscle)
- (2) abductor pollicis brevis (the lat. m. of thenar eminence)
- (3) flexor " " (the med. m. of thenar eminence)
- (4) opponens pollicis (deep to the previous 2 muscles)

* N. supply : all supplied by median n. except adductor pollicis which is supplied by ulnar nerve.

(C) Muscles of the hypothenar eminence : 3

* N. Supply : all supplied by ulnar nerve.



FLEXOR RETINACULUM

* It is a thick fibrous band which retains the flexor tendons in front of wrist.

* Attachments

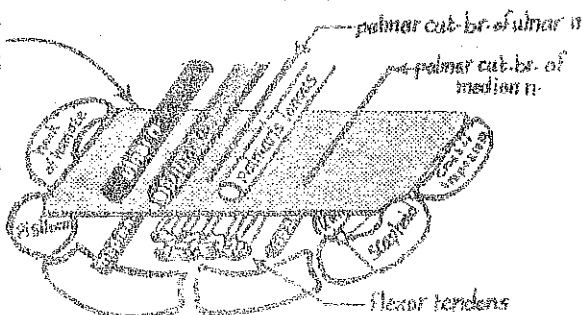
- medially : pisiform & back of hamate
- laterally : tubercle of scaphoid & crest of trapezium.

* Structures superficial to it (from med. to lat.) :

- (1) ulnar n. (2) ulnar a. (3) palmar cut. br. of ulnar n. (4) palmaris longus tendon (5) palmar cut. br. of median n.

* Deep to it : the Carpal tunnel containing the following structures (arranged from med. to lat.) :

- (1) tendons of flexor digitorum superficialis & profundus (enclosed inside the ulnar bursa).
- (2) tendon of flexor pollicis longus (enclosed inside the radial bursa).
- (3) tendon of flexor carpi radialis (in a special compartment) (4) Median n.



EXTENSOR RETINACULUM

* It is a thickened band of deep fascia which retains the extensor tendons behind the wrist.

* Attachments : (1) laterally : to lower end of radius (2) medially : to styloid pr. of ulna & pisiform bone.

* structures superficial to it : - laterally : cephalic v. & superficial br. of radial n.
- medially : basilic v. & dorsal cut. br. of ulnar n.

* structures deep to it : the 6 compartments containing extensor tendons arranged as follows (from lat. to med.)



1st compartment	2nd compartment	3rd compartment	4th compartment	5th compartment	6th compartment
(1) abd. poll. longus	(1) ext. carpi rad. longus	ext. pollicis longus	(1) ext. digitorum	ext. digiti minimi	ext. carpi ulnaris
(2) ext. " brevis	(2) " " brevis		(2) " indicis		

↳ this compartment lies radial to Guyon's tubercle on the wrist

SYNOVIAL SHEATHS OF THE HAND

3 digital synovial sheaths

15

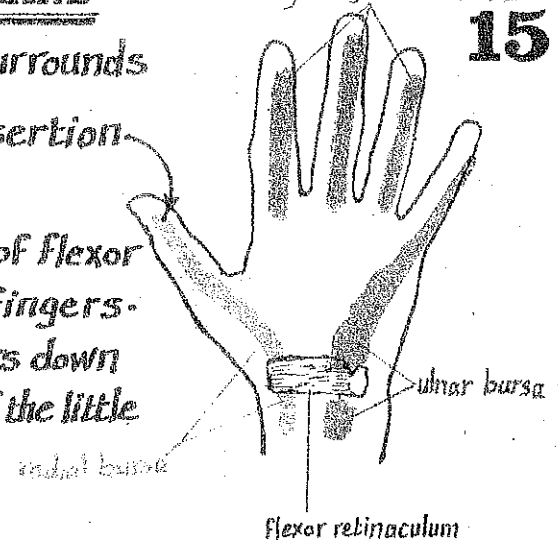
(1) **Radial bursa**: begins 1" above the wrist & surrounds the tendon of flexor pollicis longus as far as its insertion.

(2) **Ulnar bursa**:

- begins 1" above the wrist & surrounds the tendons of flexor digitorum superficialis & profundus of the med. 4 fingers.
- it extends around the tendons of the middle 3 fingers down to the middle of the palm but surrounds the tendons of the little finger as far as their insertions

(3) **Digital Synovial sheaths**:

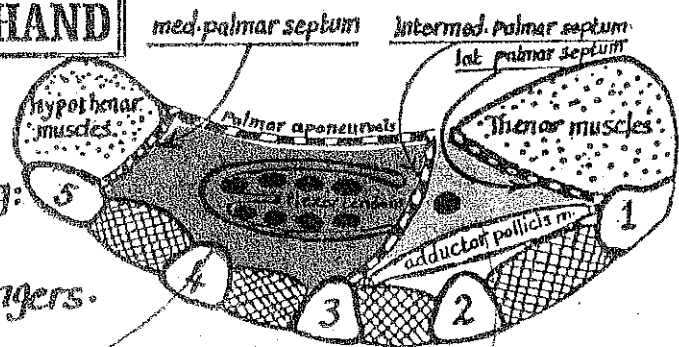
- in the middle 3 fingers, the synovial sheaths extend around the flexor tendons from the level of the distal palmar crease to the level of the distal phalanx.
- in the little finger, the synovial sheath is continuous proximally with the ulnar bursa. Distally, it extends around the flexor tendons as far as the distal phalanx.
- in the thumb, the synovial sheath is continuous proximally with the radial bursa.



SPACES OF THE HAND

* the arrangement of the fascial septa in the hand leads to the formation of many surgically important spaces (may become infected) including:

- (1) midpalmar space (2) the thenar space
(3) web spaces (4) the pulp space of fingers.

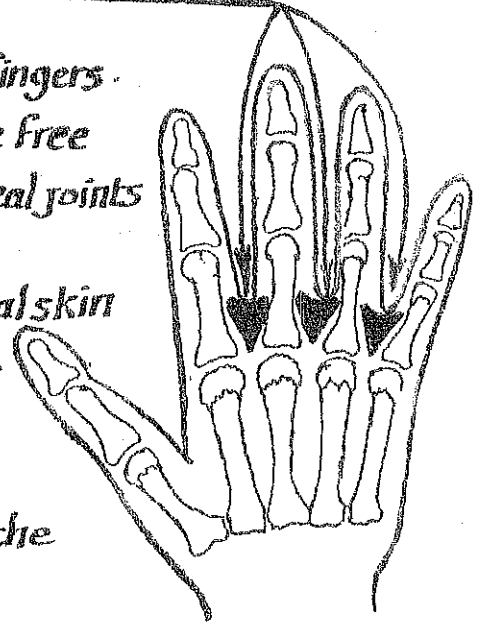


Features		Mid palmar space	Thenar space
Site:		deep to med. ½ of the hollow of palm	deep to lat. ½ of the hollow of palm.
Boundaries	ventrally	palmar aponeurosis	palmar aponeurosis
	dorsally	2nd, 4th & 5th metacarpals & intervening interosseous muscles.	transverse head of adductor pollicis & its covering fascia
	medially	the med. palmar septum	the intermediate palmar septum.
	laterally	the intermediate palmar septum	the lateral palmar septum.
Communications	proximally	with the space of Parona in forearm	
	distally	with the web spaces between the med. 4 fingers	with the web space between the thumb & index.
Contents:		(1) tendons of fl. digitorum superficialis & profundus to the med. 3 fingers (2) the med. 3 lumbrical muscles (3) digital nerves & vessels to the med. 3½ fingers	(1) long flexor tendons of the thumb & index fingers. (2) the 1st (lateral) lumbrical muscle (3) digital nerves & vessels to the lat. 1½ fingers

WEB SPACES

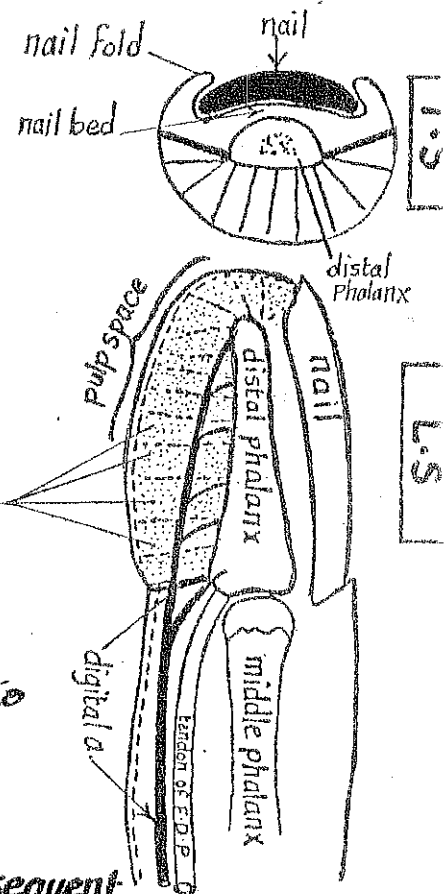
16

- * There are 3 web spaces at the clefts between the med. 3 fingers.
- * Each web space is wedge-shaped having a base at the free edge of the cleft & an apex at the metacarpo-phalangeal joints.
- * Boundaries :- on each side : base of proximal phalanx.
 - anteriorly : palmar skin - posteriorly : dorsal skin
- * Contents : each space contains fat & a lumbrical muscle.
- * surgical importance :
 (1) an abscess in the web space usually points dorsally.
 (2) infection may spread along lumbrical muscles to reach the midpalmar space or the thenar space.



PULP SPACE

- * Definition : it is the subcutaneous tissue of the terminal phalanx of the fingers (finger tips)
- * It is a closed space being separated from the middle phalanx by the interphalangeal crease & shut off on both sides & distally by a septum extending from the skin to the periosteum of the terminal phalanx.
- * it is divided into large number of small loculi filled with fat by fibrous septa extending from the skin to the periosteum.
- * surgical importance :
 (1) pulp space infection produces severe throbbing pain due to rising tension in a closed space.
 (2) severe pulp space infection produces thrombosis of the branches of the digital a. supplying the bone with consequent necrosis of the shaft of the terminal phalanx. The base of the phalanx is not affected as it receives a br. of the digital a. before entering the pulp space.



ARTERIES OF THE U.L

17

1. AXILLARY ARTERY

* Begins: at the outer border of the 1st rib as a continuation of subclavian a.

* Ends: at the lower border of teres major m. by becoming the brachial a.

* Its Course: is divided by pectoralis minor m. into 3 parts:

1) 1st part: above the m. 2- 2nd part: behind the m. 3- 3rd part: below the m.

* Branches:

1st part: gives 1 br.: sup. thoracic a.

2nd part: " 2 brs.: (1) acromiothoracic a. (2) lat. thoracic a.

3rd part: " 3 brs.: (1) subscapular a. (the largest br.)
(2) post. circumflex humeral artery
(3) ant. circumflex humeral artery.

2. BRACHIAL ARTERY

* Begins: at the lower border of teres major m.

* Ends: in the cubital fossa opposite the neck of radius by dividing into radial & ulnar arteries.

* Course: its upper 1/2 lies med. to the humerus while its lower 1/2 lies in front of the humerus.

* Branches:

(1) profunda brachii a.: the 1st & largest br. It runs with radial n. in the spiral groove. It ends by dividing into an ascending br. & 2 descending brs.

(2) sup. ulnar collateral a.: accompanies ulnar n. → back of med. epicondyle.

(3) inf. ulnar collateral a.: descends in front of the med. epicondyle.

(4) nutrient a. to the humerus (5) muscular branches.



3. ULNAR ARTERY

* Begins: in the cubital fossa as the larger terminal br. of brachial a.

* Ends: in the palm by becoming the superficial palmar arch.

* Course: it descends along the med. side of the front of forearm.

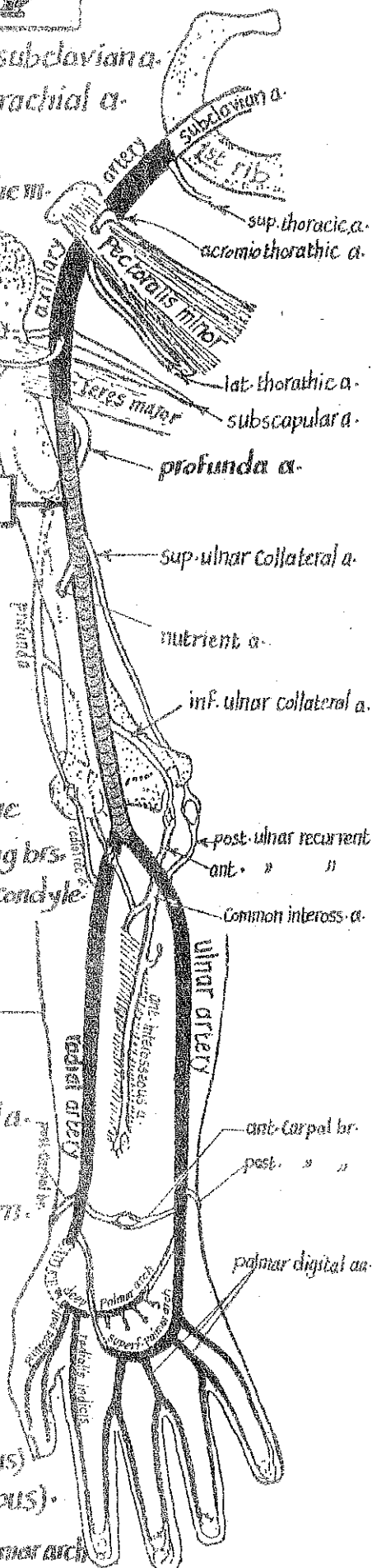
* Branches:

A- At elbow:
 1- ant. ulnar recurrent a. } share in the anastomosis around elbow.
 2- post. " recurrent a. }
 3- Common interosseous a.: divides into ant. & post. interosseous arteries.

B- in the forearm: → 4- muscular branches.

C- At the wrist:
 5- ant. carpal br. (anast. in front of carpus)
 6- post. " " (" behind the carpus).

D- in the palm:
 7- deep palmar br. to complete the deep palmar arch
 8- branches of the superficial palmar arch: 4 palmar digital arteries to the med. 3 1/2 fingers.



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* **Branches:**

A- **At elbow:**

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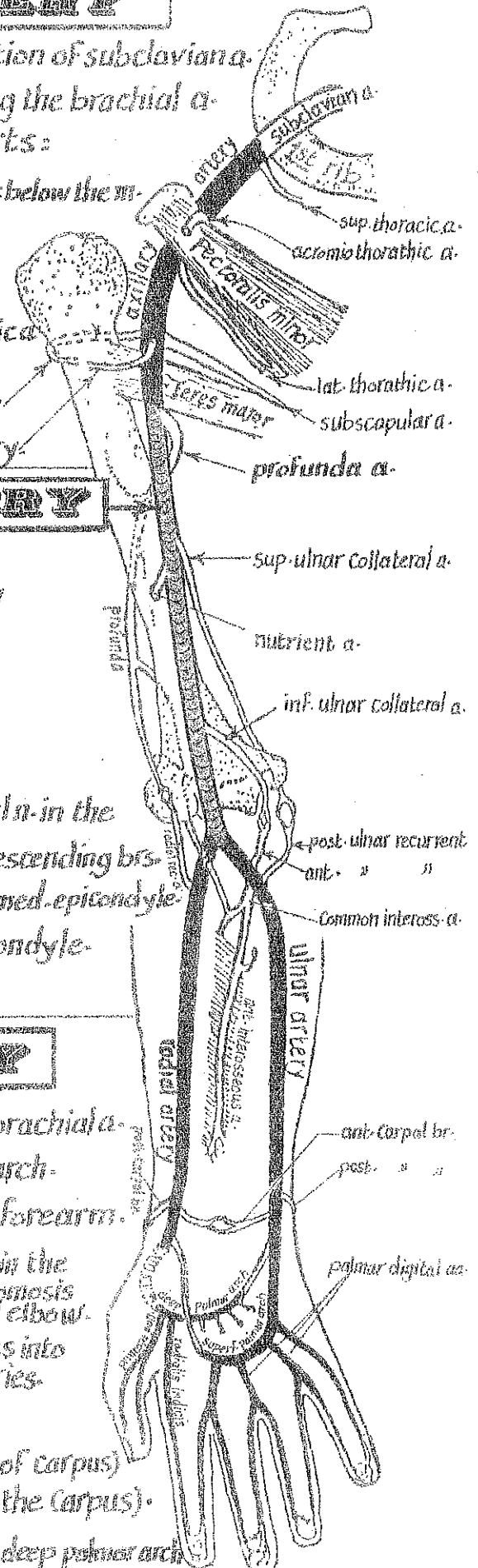
B- **in the forearm:** → 4- muscular branches.

C- **At the wrist:**

- 5- ant. carpal br. (anast. in front of carpus)
- 6- post. " " (" behind the carpus).

D- **in the palm:**

- 7- deep palmar br. to complete the deep palmar arch
- 8- branches of the superficial palmar arch: 4 palmar digital arteries to the med. 3 1/2 fingers.



IV- Anastomosis around the Wrist :

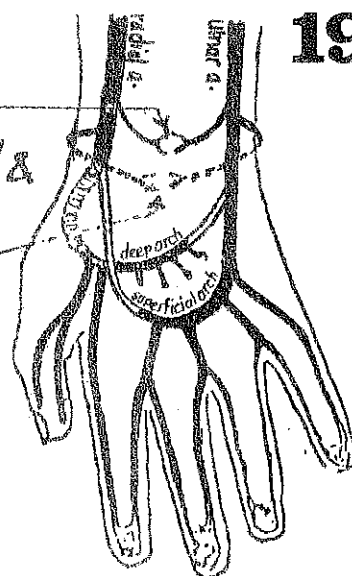
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A- Anterior carpal arch

formed by anastomosis of the ant-Carpal branches of radial & ulnar arteries in front of the wrist

B-Post-Carpal arch

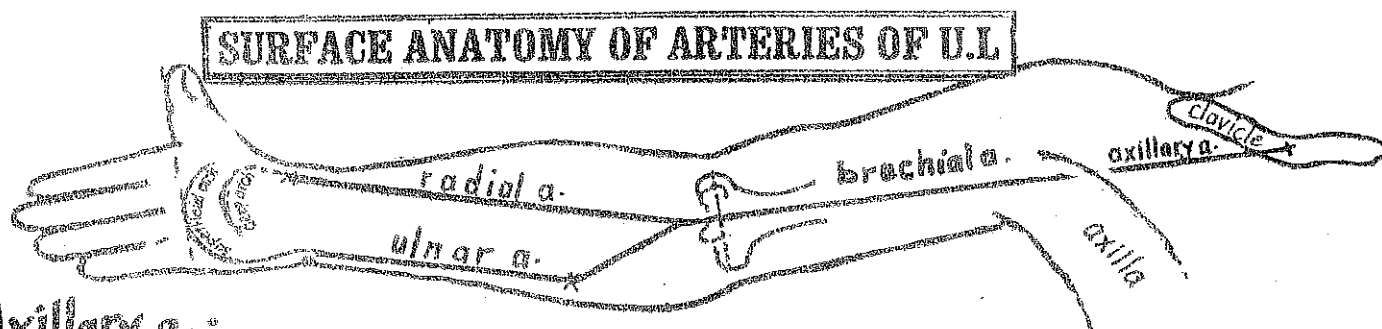
formed by anastomosis of the post-Carpal branches of radial & ulnar arteries behind the wrist.



V- Anastomosis in the hand :

- (1) deep palmar arch: formed mainly by radial a. & completed by a br. of ulnar a.
- (2) superficial palmar arch: " " " ulnar a. & " " " " " radial a.
- (3) anastomosis in the digits between the digital arteries.

SURFACE ANATOMY OF ARTERIES OF U.L



(1) Axillary a. :

with the arm abducted 90° & the forearm supinated, draw a line from the midclavicular point to a point 1 cm below the midcubital point. The axillary a. lies on this line above the post-axillary fold.

(2) Brachial a. : lies on this line below the level of the post-axillary fold

(3) Radial a. : lies along a line joining the termination of the brachial a. with the styloid process of radius (or the point where radial pulse is felt at wrist).

(4) Ulnar a. :

(a) its upper oblique part : draw a line from the end of brachial a. to a point on the med. border of the forearm at the junction of the upper 1/3 & lower 2/3

(b) its lower vertical part : draw a line from the last point to a point just lat. to the pisiform bone.

(5) the Superficial palmar arch : draw a transverse line across the palm at the level of the distal border of the fully extended thumb.

(6) the deep palmar arch : draw a line one finger breadth proximal to the line of the superficial arch.

NERVES OF THE U.L

20

BRACHIAL PLEXUS lies in the post. Δ of neck & axilla & is formed of:

(A) **Roots**: the ant. rami of C5, 6, 7, 8 & T1

(B) **Trunks** { (1) upper trunk: by union of C5 & 6
(2) middle " : " C7 alone
(3) lower " : by union of C8 & T1

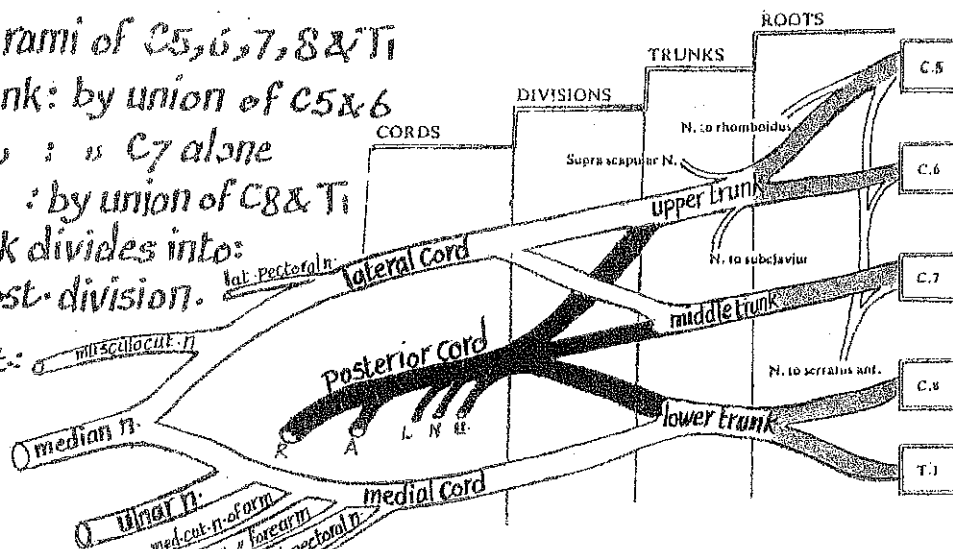
(C) **Divisions**: each trunk divides into:
ant. & post. division.

(E) **Cords**: med., lat. & post.:

(1) **med. cord**: formed by
the ant. division of the
lower trunk only.

(2) **lat. cord**: formed by the union of the ant. divisions of the upper & middle trunks.

(3) **post. cord**: formed by the union of the post. divisions of the 3 trunks.



THE BRANCHES OF B. PLEXUS

Branches of lat. cord	Branches of med. cord	Branches of post. cord
(1) lat. pectoral n.	(1) med pectoral n.	(1) Upper subscapular n.
(2) musculocutaneous	(2) med cut. n. of arm	(2) Lower " "
(3) lat. root of median n.	(3) " " " " forearm	(3) N. to latissimus dorsi
	(4) ulnar n	(4) Axillary n.
	(5) med. root of median n.	(5) RADIAL n.

* **Branches of the roots**: (1) n. to rhomboids (C5) (2) n. to serratus ant. (C5, 6, 7).

* **Branches of the upper trunk**: (1) suprascapular n. (C5, 6) (2) n. to subclavius (C5, 6)

INJURY OF THE BRACHIAL PLEXUS

(1) **Complete avulsion of all roots** of the plexus: leads to:

(a) paralysis of all muscles of upper limb except trapezius

(b) anaesthesia of all skin of U.L except skin of tip of shoulder & floor of axilla.

(2) **Injury of the upper trunk (C5, 6)**: Erb's paralysis: leads to:

(a) paralysis of abductors & lat. rotators of arm + flexors & supinators of forearm

(b) anaesthesia of skin of lat. aspect of forearm & lower 1/2 of arm.

(c) Deformity: porter's or policeman tip position.

(3) **Injury of the lower trunk (C8, T1)**: Klumpke's paralysis: leads to:

(a) paralysis of flexors of wrist & fingers + all intrinsic muscles of the hand.

(b) anaesthesia of the skin along the ulnar border of forearm & hand.

(c) Deformity: claw hand deformity.





MEDIAN N. (C5,6,7,8,T1)

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* It is a mixed n. arising by 2 roots (med. & lat.) from the med. & lat. cords

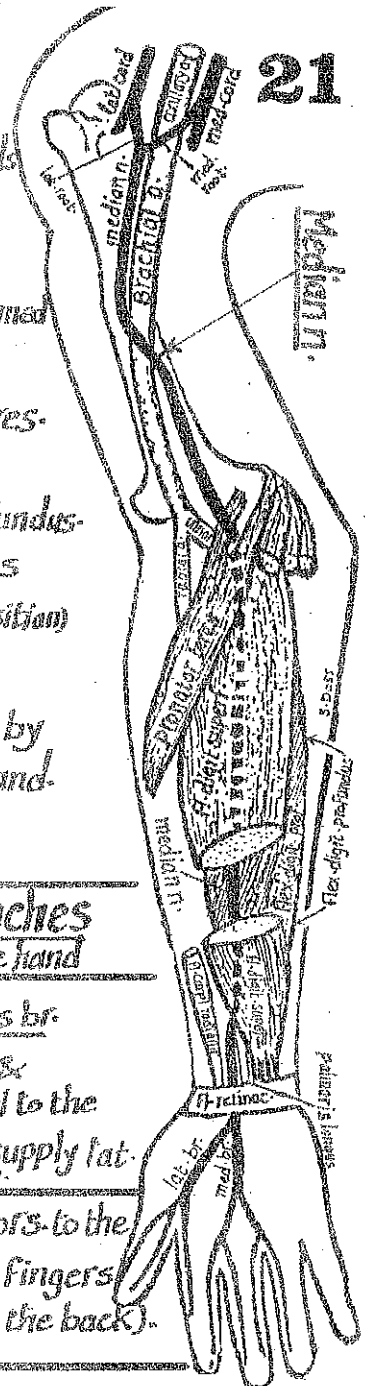
* Course & relations :

- (1) in the upper 1/2 of arm : it descends lat. to the brachial artery.
- (2) at the middle of the arm : it crosses in front of the artery from lat. to med.
- (3) in the lower 1/2 of arm : it descends on the med. side of brachial a.
- (4) in the cubital fossa it passes between the 2 heads of pronator teres.
- (5) in the forearm : it descends along the middle line of the front of forearm between flex. dig. superficialis & fl. dig. profundus.
- (6) 5 cm. above wrist : it becomes superficial, lying between the tendons of palmaris longus & flex. carpi radialis (dangerous position)
- (7) it enters the hand : by passing through the carpal tunnel.

* Termination : it ends at the distal border of the flex. retinaculum by dividing into med. & lat. terminal branches to the hand.

* BRANCHES OF MEDIAN NERVE

Site	Motor branches (to 1 1/2 muscles in the forearm & hand)	Sensory branches to the lat. 2/3 of the hand
Forearm	(1) <u>Median n. itself</u> : supplies 4 muscles : pronator teres, flex. carpi rad., palmaris longus & F.D.S. (2) its <u>ant. interosseous br.</u> supplies 2 1/2 muscles flexor pol. longus, pronator quadratus & lat. 1/2 of F.D.P.	(A) <u>palmar cutaneous br.</u> arises above wrist & descends superficial to the flex. retinaculum to supply lat. 2/3 of the palm.
Hand	the terminal brs. of median n. supply 5 mm. : - 3 thenar muscles (abd. -> flex. & opposens pol.) - lat. 2 lumbrical muscles.	5 palmar digital brs. to the skin of the lat. 3 1/2 fingers (front + distal 1/2 of the back).



INJURY OF MEDIAN NERVE

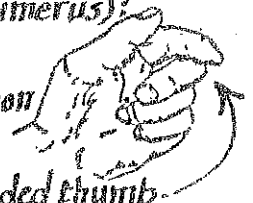
I-Above elbow : (caused by : penetrating wounds, gunshots or fractures of humerus) :

(A) Motor affection : paralysis of all the 1 1/2 muscles supplied (mention them) leading to :

- (1) weak flexion with ulnar deviation of wrist
- (2) loss of pronation
- (3) loss of flexion & opposition of the thumb.

(B) Deformity : Monkey (Ape) hand : flat thenar eminence with adducted hyperextended thumb.

(C) Sensory loss : from the skin of the lat. 2/3 of the palm + the lat. 3 1/2 fingers anteriorly & their distal halves posteriorly



II-Below elbow : (caused mainly by lacerations at the wrist) leading to :

(A) Motor affection : paralysis of the 5 hand muscles only. (B) Monkey hand deformity.

(C) Sensory loss : as in above elbow affection.



III Inside the Carpal tunnel (Carpal tunnel Syndrome) : the effects are like below elbow injury but with no sensory loss in the palm.



ULNAR NERVE

C7,8 & T1

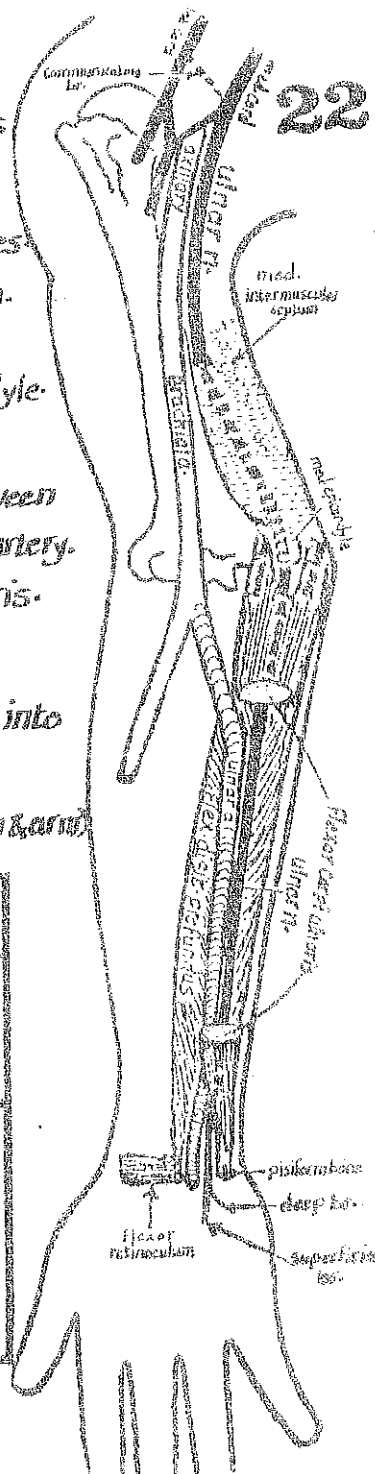
It is a mixed n. arising as the largest br. of the med. cord of br. plexus

Course & relations:

- (1) in axilla & upper $\frac{1}{2}$ of arm: it descends med. to axillary & brachial arteries
- (2) at the middle of the arm: it pierces the med. intermuscular septum of arm.
- (3) in the lower $\frac{1}{2}$ of the arm: it descends in the post. compartment behind the med. intermuscular septum down to the back of med. epicondyle.
- (4) At elbow: it enters between the 2 heads of Flexor Carpi ulnaris
- (5) in the forearm: it descends along the med. side of the front of forearm between Flexor carpi ulnaris & flex. digit. profundus, lying med. to ulnar artery.
- (6) 5 cm. above wrist: it becomes superficial, lying just lat. to flex. carpi ulnaris.
- (7) it enters the hand by passing superficial to the flexor retinaculum.

Termination: it ends at the distal border of flex. retinaculum by dividing into superficial & deep terminal branches to the hand.

Branches: it gives its branches in the forearm & hand (no branches in axilla & arm)



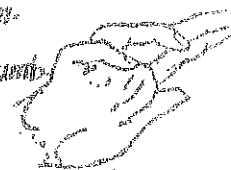
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Branch site	Motor branches	Sensory branches
Forearm	to $1\frac{1}{2}$ muscles only: - Flexor carpi ulnaris. - med. $\frac{1}{2}$ of flex. digit. profundus	- palmar cut. br.: to med. $\frac{1}{3}$ of palm - dorsal " " : to med. $\frac{1}{3}$ of dorsum of hand & dorsum of med. $1\frac{1}{2}$ fingers.
Hand	- superficial terminal br. supplies one muscle only: palmaris brevis - deep terminal br. supplies: • the 8 interossei + med. 2 lumbricals • the 3 hypothenar m. • add. pollicis & maybe flex. pol. brevis	- superficial terminal br. gives 3 palmar digital nerves to the palmar surfaces of the med. $1\frac{1}{2}$ fingers.

INJURY OF ULNAR NERVE

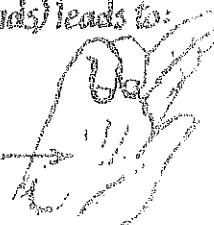
I- Above elbow: (caused by penetrating wounds, gunshots, fracture of med. epicondyle), leads to:

- (A) **motor affection:** paralysis of all muscles supplied ($1\frac{1}{2}$ in the forearm & 15 in the hand) resulting in:
 (1) weak flexion, with radial deviation of the wrist (2) inability to put the hand in writing position.
 (3) inability to flex the terminal phalanges of the med. 2 fingers (4) loss of adduction of thumb.
- (B) **Deformity:** partial claw-hand deformity.
- (C) **Sensory loss:** in the med. $\frac{1}{3}$ of the hand & med. $1\frac{1}{2}$ fingers both anteriorly & posteriorly.



II- Below the elbow (at or above the wrist): (caused by lacerations or cut wounds) leads to:

- (A) **Motor affection:** limited to the hand muscles only
- (B) **Deformity:** Complete claw hand: more severe clawing than in above wrist injury.
- (C) **Sensory loss:** from the palmar surfaces of the med. $1\frac{1}{2}$ fingers only.



RADIAL NERVE (C5, 6, 7, 8 & T1)

It is a mixed n. arising as the largest br. of post. cord of the Br. plexus.

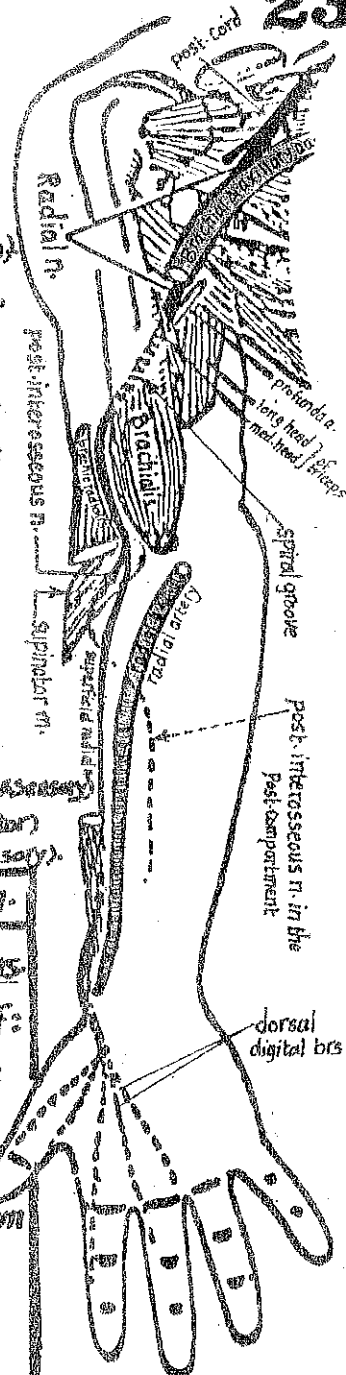
Course & relations:

- (1) in axilla & upper $\frac{1}{3}$ of arm: it descends behind axillary a. & brachial a.
- (2) in the middle $\frac{1}{3}$ of arm: it lies on the spiral groove on the back of humerus (with profunda a.)
- (3) in the lower $\frac{1}{3}$ of arm: it descends in the groove between brachialis & brachioradialis.
- (4) At elbow: it ends in front of the lat. epicondyle by dividing into 2 terminal brs.:

(a) post. interosseous n. (Motor) & (b) superficial radial n. (sensory).

(A) Post. interosseous n.: pierces the supinator m., turns backwards lat. to the neck of radius then emerges from the post. surface of supinator to reach the post. compartment of forearm where it descends between its superficial & deep m.

(B) Superficial radial n.: descends along the lat. side of the front of forearm (lat. to the radial a.), under cover of brachioradialis m. till the lower $\frac{1}{3}$ of the forearm where it turns backwards to reach the dorsum of the hand where it ends by dividing into 5 dorsal digital branches



* BRANCHES OF RADIAL NERVE

- (a) br. of the main trunk (motor)
- (b) br. of post. interosseous n. (motor)
- (c) = superficial radial n. (sensory).

Main trunk of radial n.	Post. interosseous nerve	superficial radial n.
A. Motor brs.: to 5 muscles: TABEB (1) Triceps (2) Anconeus (3) Brachialis (lat. part) (4) Ext. carpi radialis longus (5) Brachioradialis . (B) Sensory brs.: 3 (1) lower lat. cut. n. of arm (2) post. cut. n. of arm (3) post. cut. n. of forearm.	(A) motor brs. to the 5 deep muscles of post. compartment of forearm: (1) supinator (2) abd. pol. longus (3) ext. pol. bris (4) ext. pol. longus (5) ext. indicis (B) motor brs. to 4 superficial muscles of post. compartment of forearm: (1) ext. carpi rad. brevis (2) ext. digitorum (3) ext. digiti minimi (4) ext. carpi ulnaris i.e. it supplies the superficial group except the muscles number 1, 2, 7: (1) brachioradialis (2) ext. carpi rad. longus } remember no. 127 (7) anconeus	5 dorsal digital brs. to supply the skin of: (1) the lat. $\frac{2}{3}$ of the dorsum of hand (2) dorsum of the lat. $\frac{3}{4}$ fingers down to their middle phalanges

INJURY OF RADIAL NERVE

	Site & Causes	Motor affection	Deformity	Sensory affection
I-	<u>In axilla:</u> caused by: (1) crutch palsy (2) operation table palsy. (3) Saturday night palsy.	- paralysis of elbow extensors (triceps) - " " wrist extensors - " " finger extensors	elbow drop wrist drop finger drop	limited to the cleft between 1st & 2nd metacarpal bones due to the overlap by other sensory nerves to the skin area supplied by the radial nerve.
II-	<u>In the spiral groove:</u> (1) by fracture humerus. (2) by wrong I.V. injection.	- paralysis of wrist extensors - paralysis of finger extensors - extension of elbow is normal due to intact long & med. heads of triceps	wrist drop finger drop	
III-	<u>Post. interosseous n. injury:</u> by fracture neck of radius.	- only paralysis of finger extensors - extension of wrist is normal due to normal ext. carpi radialis longus	finger drop only	No Sensory loss.
IV-	<u>superficial radial n. injury</u> by lacerations at wrist.	No Motor affection	No deformity	as in I & II.



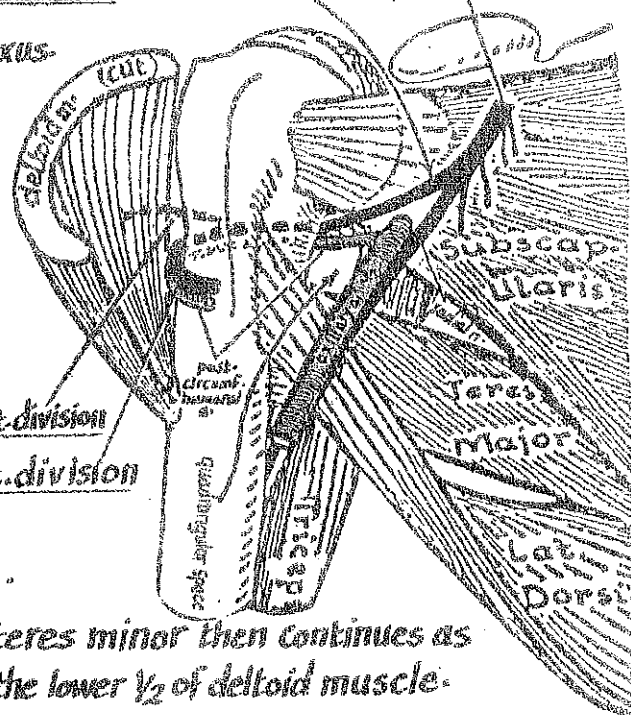
AXILLARY (CIRCUMFLEX) N. (C5,6)

post. cord 24

* It is a mixed n. arising from the post. cord of B. plexus.

* Course & relations:

- (1) at its origin it lies behind 3rd part of axillary artery.
- (2) it passes backwards through the quadrangular space (accompanied by post-circumflex humeral a.)
- (3) then it turns around the surgical neck of humerus just below the Capsule of shoulder joint
- (4) It ends on the back of humerus by dividing into



* Branches:

- (a) the ant. division: gives motor brs. to the deltoid m.
- (b) the post. division: gives motor brs. to the teres minor & teres major then continues as the upper lat. cut. n. of arm which supplies the skin over the lower 1/2 of deltoid muscle.

* Injury of the axillary n.:

- Causes: (1) Fracture of surgical neck (2) downward dislocation of the head of humerus
- Effects: (A) Motor: paralysis of teres minor & deltoid & inability to abduct shoulder from 15° to 90°
- (B) Sensory: loss of skin sensation over the lower 1/2 of deltoid.
- (C) Deformity: flat shoulder (due to atrophy of deltoid).

MUSCULOCUTANEOUS N. (C5,6,7)

* It is a mixed n. arising as the largest br. of the lat. cord of Br. plexus.

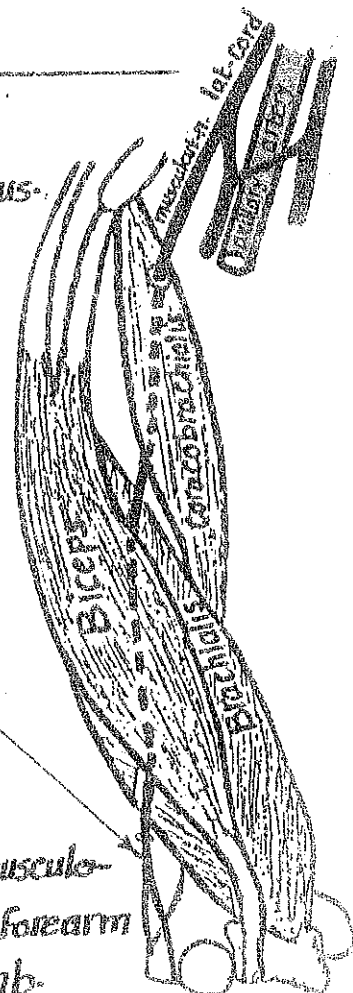
* Course & relations:

- (1) At its origin it lies lat. to the 3rd part of axillary artery.
- (2) it leaves the axilla by piercing the coracobrachialis m.
- (3) then it descends downwards & laterally between biceps & brachialis.
- (4) It appears on the lat. side of biceps, 2" above the elbow.
- (5) Finally, it pierces the deep fascia & continues along the lat. border of the forearm as the lateral cutaneous n. of forearm.

* Branches:

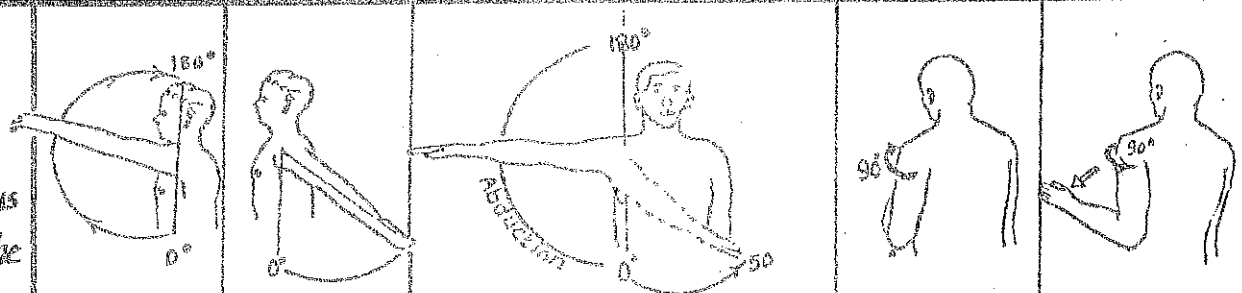
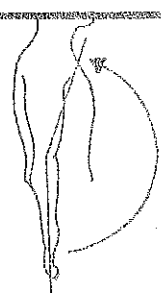
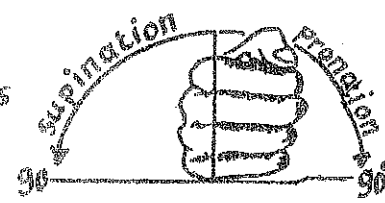
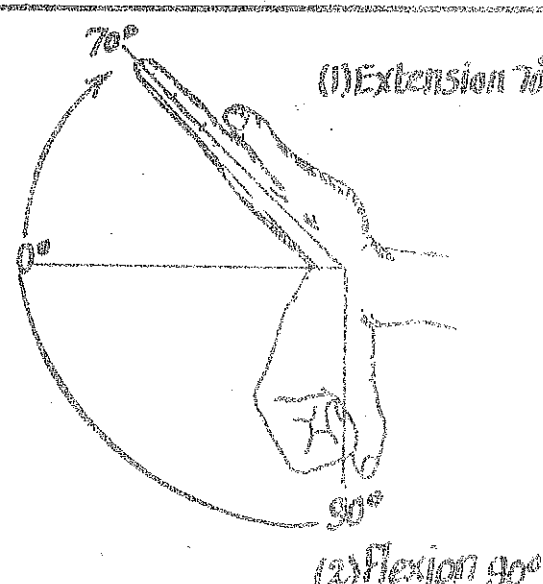
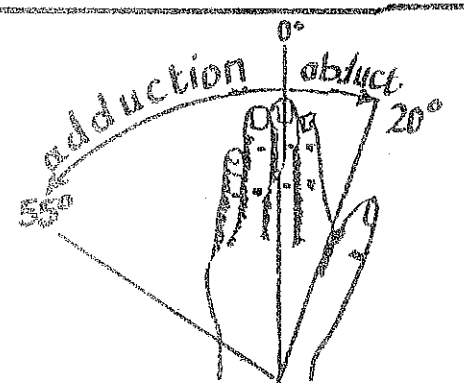
- (1) Motor: to 3 muscles
 - (a) coracobrachialis.
 - (b) biceps.
 - (c) brachialis.

- (2) Cutaneous: the lat. cut. n. of forearm (the continuation of musculocutaneous n.) supplies the skin of lat. aspect of forearm down to the upper part of the ball of the thumb.



JOINTS OF UPPER LIMB

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Joint	Movements allowed & its range						
(1) <u>Sternoclavicular</u> Synovial, saddle	both are responsible for movements of shoulder girdle (clavicle & scapula). (1) elevation (4) retraction (2) depression (5) upward rotation of glenoid cavity (3) protraction (6) downward rotation of glenoid cavity.						
(2) <u>Acromioclavicular</u> synovial, plane							
(3) <u>Shoulder J.</u> synovial, ball & socket between the head of humerus & glenoid cavity of the scapula, allowing wide range of movements	 <table><tr><td>(1) Flexion 180°</td><td>(2) Extension 50°</td><td>(3) Abduction 180°</td><td>(4) Adduction 50°</td><td>(5) Int-rotation 90°</td><td>(6) Ext-rotation 90°</td></tr></table>	(1) Flexion 180°	(2) Extension 50°	(3) Abduction 180°	(4) Adduction 50°	(5) Int-rotation 90°	(6) Ext-rotation 90°
(1) Flexion 180°	(2) Extension 50°	(3) Abduction 180°	(4) Adduction 50°	(5) Int-rotation 90°	(6) Ext-rotation 90°		
(4) <u>Elbow J.</u> synovial, hinge between lower end of humerus & upper ends of radius & ulna	 1- Flexion 145°-160° 2- Extension 0°						
(5) <u>Sup. & inf radioulnar joints</u> synovial, pivot	they allow rotatory movements around a longitudinal axis passing through the 2 joints (1) Supination 90° (2) Pronation 90° 						
(6) <u>Wrist joint</u> a synovial ellipsoid between the lower end of radius & the carpal bones scaphoid, lunate & triquetral	 (1) Extension 70° (2) Flexion 90°  (3) adduction (ulnar deviation): 55° (4) abduction (radial "): 20°						

IMPORTANT REAGIONS OF U.I

* Development: 1- Female breast

(1) an ectodermal thickening called the mammary line extends from axilla to groin

This line late disappears except in the thoracic region.

(2) 15-20 solid ectodermal buds arise from the thoracic part of the mammary line & sink into the underlying mesoderm where they branch repeatedly then canalize to form the lactiferous ducts which form the breast lobes.

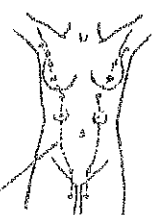
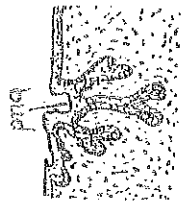
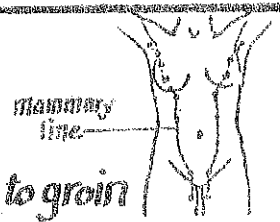
* Congenital anomalies:

(1) micromastia: abnormally small breast

(2) macromastia: " large breast

(3) poly mastia: presence of accessory breast(s) anywhere along the mammary line

(4) poly thelia: presence of accessory nipple(s) anywhere along the mammary line.



Anatomy of the breast

* Shape: hemispherical with its base applied to the ant-chest wall & its apex at the nipple.

* Extent: the base extends from the 2nd rib (above) to the 6th rib (below) & from the lat. margin of sternum (med.) to the midaxillary line (lat.).

N.B: the axillary tail of the breast pierces the deep fascia (through the foramen of Langer) to enter the axilla.

* Deep relations: the base of the breast lies on the following:

(1) pectoralis major m. with its covering deep fascia.

(2) serratus anterior m.

(3) external abd-oblique m. } deep to the inferolat. 2/3 of the base of breast

(4) the upper most part of rectus sheath: deep to the inferomed part.

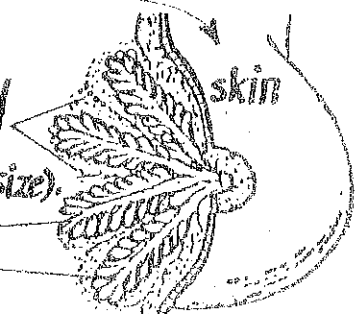
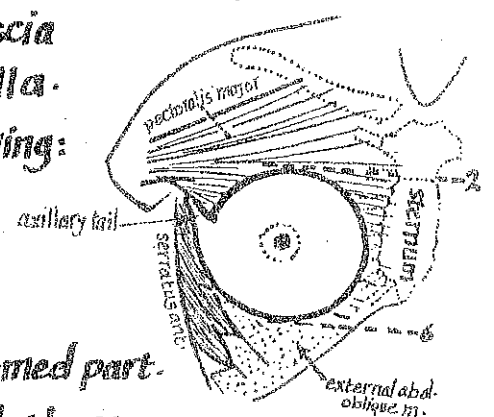
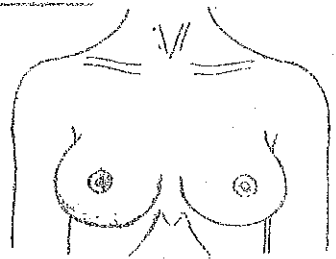
N.B: the breast is separated from the previous structures by loose areolar tissue (sometimes called the submammary space) allowing free mobility of breast.

* Structure: the breast consists of the following components:

(1) the covering skin including the nipple & areola.

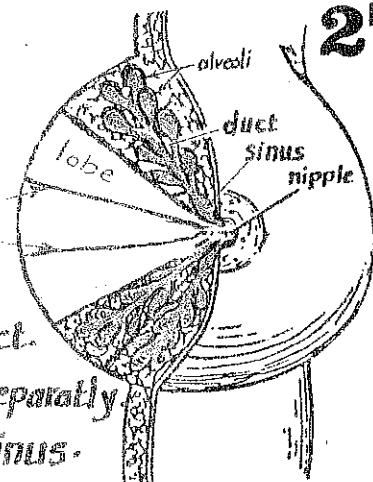
(2) the superficial fascia in which the mammary gland is embedded (including the fibrous tissue framework & the fat giving the breast its size).

(3) the Mammary gland: a modified sweat gland



* Mammary gland:

- Consists of 15-20 lobes converging towards the nipple.
- the lobes are separated from each other by fibrous septa (Cooper's ligaments) which extend from the skin to the deep fascia.
- each lobe consists of cluster of alveoli drained by a lactiferous duct.
- the lactiferous ducts converge towards the nipple & open on it separately.
- each duct has a dilatation near its end called the lactiferous sinus.



* Nipple: a conical projection just below the centre of the breast (opposite 4th intercost. space).

- it is pierced by 15-20 lactiferous ducts & contains circular & longitudinal smooth muscle fibres which can make the nipple erect or flat.

* Areola: a circular area of pigmented skin surrounding the base of the nipple.

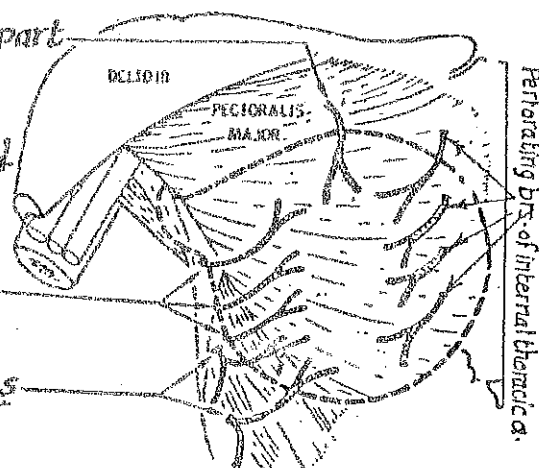
- it is rich in modified sebaceous glands which become enlarged during pregnancy & lactation forming raised tubercles (of Montgomery).

N.B: the skin of the nipple & areola is devoid of hairs & has no fat beneath it.

* V.B: the Male breast: differs from the female breast in being rudimentary & its glandular tissue consists only of ducts with no alveoli

* Arterial Supply of the breast: it is supplied by:

- (1) pectoral br. of thoracoacromial a.: supplies the upper part
- (2) Perforating brs. of internal thoracic a.: the 2nd, 3rd & 4th branches are especially large to supply the med. part of the breast.
- (3) branches of the lateral thoracic artery supply the lateral part of the breast.
- (4) lateral branches of posterior intercostal arteries supply the lower & lat. parts of the breast.



* Venous drainage: the veins of the breast drain into:

- (1) axillary v. (2) internal thoracic v. (3) intercostal veins

* Nerve Supply of the breast:

by the ant. & lat. branches of the 4th, 5th & 6th intercostal nerves which supply:

- (a) Sensory fibres: to the skin of the breast.
- (b) autonomic " : to the smooth muscles & blood vessels.

N.B: the nerves have no role in the secretion of milk (controlled by prolactin hormone).

A-Classical description

ast

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lobule

lobule

lobule

ray septa

pectoralis major

pectoral fascia

- It communicates with the subareolar & the submammary plexuses.*

- ## II-The regional Lymph nodes draining the breast.

(1) Axillary L.N.s (mainly the pectoral, central & apical): receive 75% of the lymph

- (2) Internal mammary LNs. (of the same & opposite side): " 20% " " "
- (3) post. intercostal, subscapular & supraclavicular LNs: " 5% " " "

(A) Nipple & areola : are drained by the subareolar plexus.

- (B) remaining skin & subcutaneous tissue:

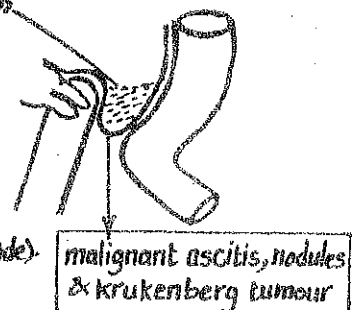
drained by the subcutaneous plexus, from which lymphatics radiate to the regional LNs as follows

- (1) upper lat. quadrant → pectoral group of axillary L.Ns.
 (2) lower " " → subscapular " " " "
 (3) upper med. " → internal mammary L.Ns of the
 same & opposite side.
 (4) Lower med. " → mediastinal L.Ns, some lymphatics

pass through rectus sheath to the falciform lig. then spread to

- C) Breast parenchyma : drained by the interlobular plexus which communicates freely with the subareolar & submammary plexuses, then lymphatics pass to the regional lymph nodes as follows :

- (1) lat. $\frac{1}{2}$ of breast parenchyma is drained mainly by the pectoral L.Ns
- (2) upper med. part of " is drained by int. mammary L.Ns (of same & opposite side).
- (3) lower med. part " " $\rightarrow$ mediastinal L.Ns & liver.



(B) Modern description

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Recent description of the lymphatic drainage of the breast claims that the role of the lymphatic plexuses is negligible & that the lymphatic vessels accompany the major blood vessels to reach the following L-Ns. directly:

- (1) 75% of the lymphatics pass to the axillary L-Ns (mainly the pectoral, central & apical).
- (2) 20% " " " " " " internal mammary L-Ns
- (3) 5% " " " " " " supra & infraclavicular, subscapular & post-intercostal L-Ns.

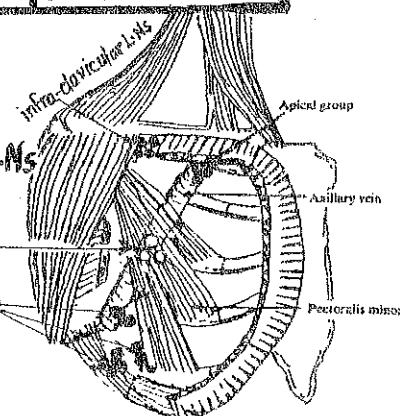
✎ AXILLARY LYMPH NODES

They are 20-30 in number & are arranged in the axilla in 5 groups as follows:

Group	Site	receives afferent lymphatics from	sends efferent lymphatics to
1-Anterior axillary (pectoral) L-Ns.	along the lower border of pectoralis minor deep to the ant-axillary fold in relation to the lat. thoracic vessels & the axillary tail of breast	upper $\frac{1}{2}$ of the ant-wall of the trunk above the level of the umbilicus (including the breast).	to the central & apical groups of axillary L-Ns.
2-posterior axillary (subscapular) L-Ns.	along the lower border of subscapularis m. in close relation to the subscapular vessels.	upper $\frac{1}{2}$ of the back of the trunk (from the neck above to the level of the iliac crest below).	
3-Lateral axillary L-Ns.	along the upper part of the humerus, closely related to the axillary V.	from the whole upper limb	
4-Central axillary L-Ns	in the upper part of the axilla closely related to the intercostobrachial n.	from the anterior, posterior & lateral groups of axillary lymph nodes.	to the apical group of axillary L-Ns.
5-Apical group	at the apex of the axilla alongside the upper part of axillary vein.	(a) from the above 4 groups (b) " deltopectoral L-Ns (c) directly from the breast. (d) Lymphatics from the U.L. which accompany cephalic V.	(1) few efferents: pass to the lower deep cervical L-Ns in the neck (2) the majority: form the sub-clavian lymph trunk

N.B: recently, the axillary L-Ns are classified into 3 levels:

- (1) L-Ns above the level of pectoralis minor : the apical & infraclavicular L-Ns
- (2) L-Ns deep to pectoralis minor : the central group
- (3) L-Ns below the level of pectoralis minor : the ant-, post- & lat-groups



THE AXILLA

It is a 4-sided pyramidal shaped space between the upper part of the arm & the upper part of the side of the thorax

Boundaries: it has apex, base & 4 walls:

I-Apex: connects the axilla with the post. A of neck.

bounded by: (a) medially: by outer border of 1st. rib

(b) posteriorly: " upper border of scapula

(c) anteriorly: " middle 1/3 of clavicle

II-Base: formed by the skin of arm pit, superficial & deep fascia

III-Ant-wall: formed by 3 muscles + fascia arranged in:

(1) superficial layer: pectoralis major m.

(2) deep layer: pectoralis minor m., subclavius & clavipectoral fascia.

N.B: Ant-axillary fold is formed by the lower border of pect-major

IV-post-wall: formed by 3 muscles (1) subscapularis (2) teres major (3) latissim. dorsi

N.B.: post axillary fold is formed by both teres major & latissim. dorsi.

V-Lat.Wall: formed of: 1-upper part of humerus

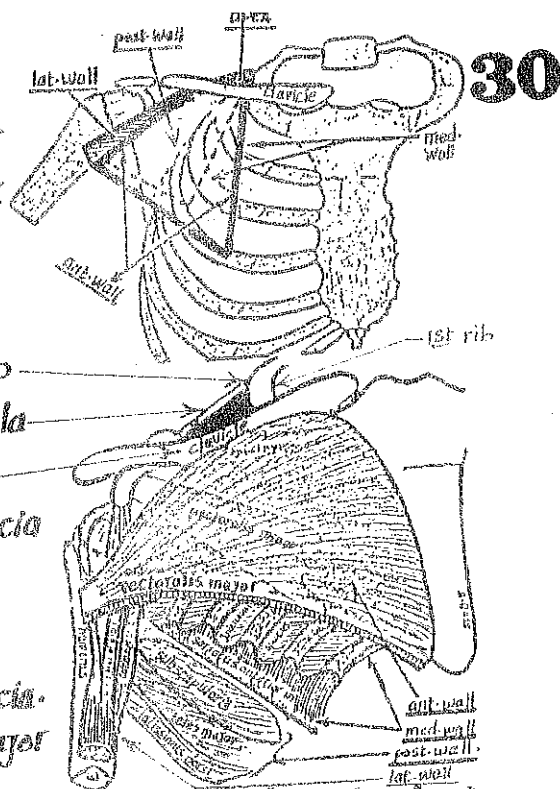
2-coracobrachialis m. (3) short head of biceps.

VI-Med-wall: formed of: (1) the upper 4 or 5 ribs & intercostal muscles

(2) serratus ant. m.

***Contents of the axilla:**

- axillary artery & vein
- cords & branches of the brachial plexus
- axillary L.Ns, fat & axillary tail of the breast.



CUBITAL FOSSA

It is the triangular depression in front of the elbow joint.

***Boundaries:**

- **Base:** represented by a line connecting the 2 humeral epicondyles.

- **medial border:** pronator teres m.

- **lateral border:** brachioradialis m.

- **apex:** formed by the meeting of the med. & lat. borders.

- **Roof:** (1) skin & superficial fascia (containing the median cubital v.).
(2) deep fascia (reinforced by the bicipital aponeurosis).

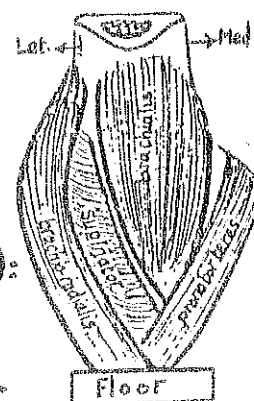
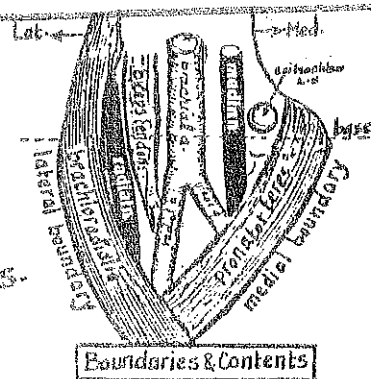
- **Floor:** formed by 2 muscles: (1) brachialis (2) supinator.

- **Contents:** it contains the following structures (arranged from med. to lat.):

(1) median n.: the most medial structure in the fossa.

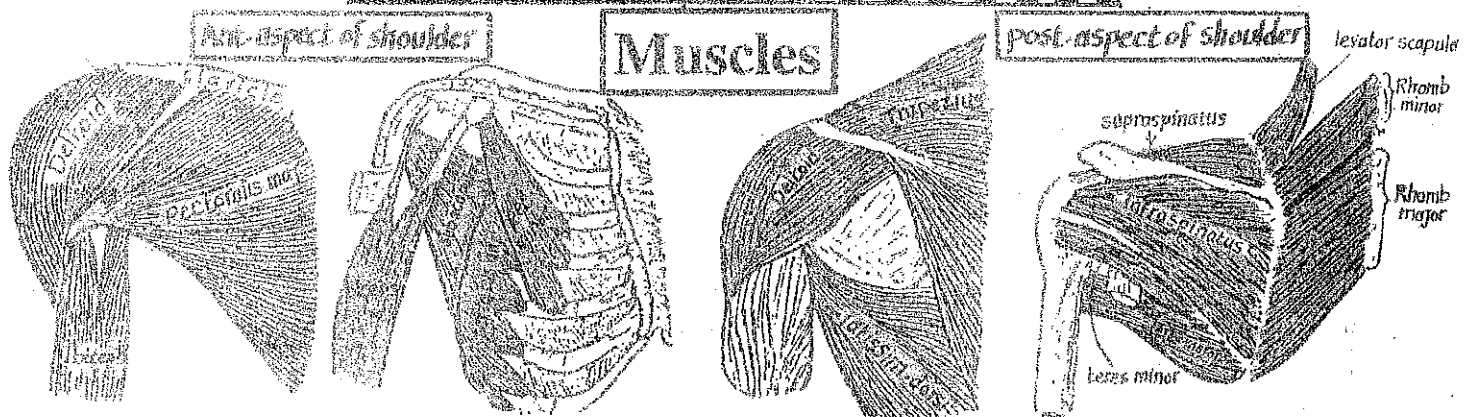
(2) brachial a.: ends in the fossa by dividing into radial & ulnar arteries.

(3) biceps tendon (4) radial n.: the most lat. structure in the fossa.



SPOTTING OF U.L.

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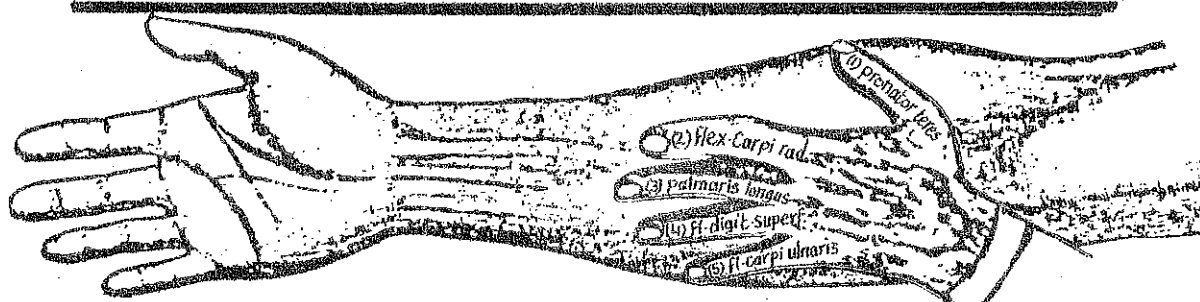


Muscle	Identifying Feature(s)
Deltoid	a rounded m. covering the tip of the shoulder.
Pectoralis major	large Δ m. in front of chest with flat tendon passing between deltoid & biceps.
pectoralis minor	small Δ m. deep to pectoralis major & inserted into coracoid process.
subscapularis	a thick m. covering the whole ventral aspect of scapula.
Serratus ant.	a thin flat m. attached to the whole med. border of scapula.
Trapezius	a Δ m. on the back, attached to the clavicle & spine of scapula opposite deltoid.
Latissimus dorsi	large m. covering the inf. angle of scapula & passing to its insertion behind the biceps (do not mistake it for pectoralis major which passes in front of biceps.
supraspinatus	a small m. adherent to the dorsal aspect of scapula above the spine.
Infraspinatus	a thick m. adherent to the dorsal aspect of the scapula below the spine.
Teres minor	a rounded m. attached to the upper part of lat. border of scapula.
Teres major	a rounded m. attached to the lower part " " " " " "
levator scapulae	a slender m. attached to upper most part of dorsal aspect of med. border of scap
Rhomboids min. group	" " the remaining " " " " " " " " " "

Biceps brachii	a muscle with 2 heads in front of the whole arm. - its <u>long head</u> is lateral & appears shorter. - its <u>short</u> " " medial & appears longer.	
Coracobrachialis	a slender m. in the upper 1/2 of front of arm & is pierced by the musculocutaneous n.	
Brachialis	a thick m. in the lower 1/2 of the front of arm deep to the biceps.	
Triceps	a thick m. covering the whole back of arm & has 3 heads : (1) <u>long head</u> : the longest, arises from the scapula. (2) <u>lat. head</u> : arises from the upper 1/3 of humerus. (3) <u>med. " " :</u> deep to the m. in the lower 1/2 of arm.	

* SUPERFICIAL MUSCLES OF FRONT OF FOREARM:

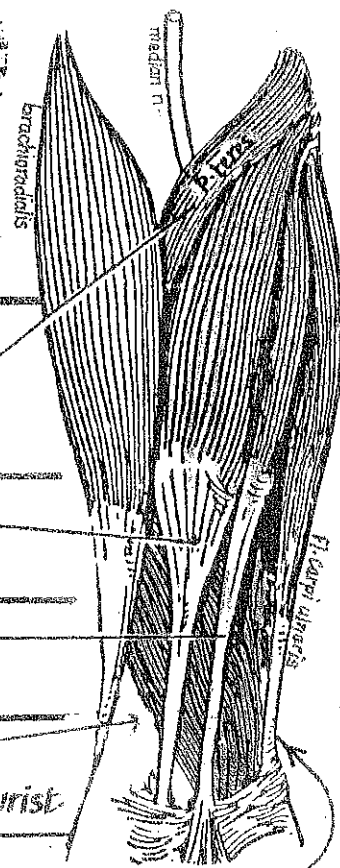
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* They are 5 muscles radiating from the front of med. epicondyle

* They are arranged from lat. to medial as follows:

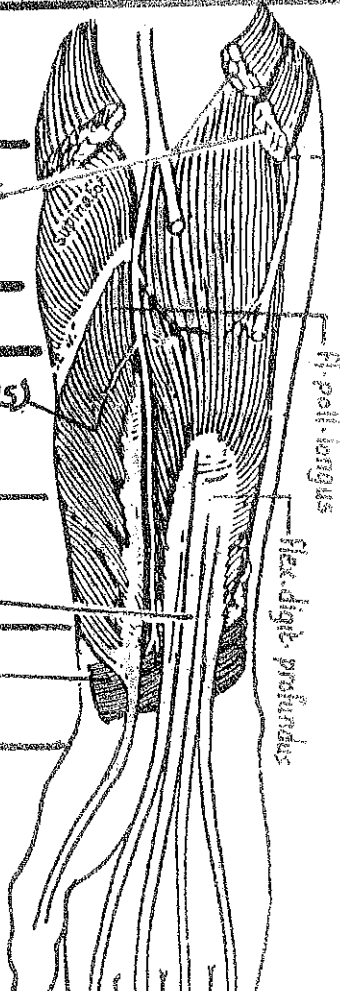
Muscle	Identifying feature(s):
1- Pronator teres	the most lat. m., crosses the upper part of the arm obliquely to get insertion in the middle of the radius.
2- Flexor Carpi radialis	lies just med. to pronator teres, has a long thick tendon descending vertically down to the wrist.
3- Palmaris longus	lies just med. to Fl. Carpi radialis with thin long tendon crossing superficial to flexor retinaculum to reach the palm.
4- Flex. digit. superficialis	a thick flat muscle lying at a deeper plane & giving 4 tendons med. to palmaris longus tendon just above the wrist.
5- Flexor carpi ulnaris	the most medial m., ends below in the pisiform bone



* DEEP MUSCLES OF FRONT OF FOREARM:

they are 3 muscles which appear after retraction of the superficial muscles & are identified as follows:

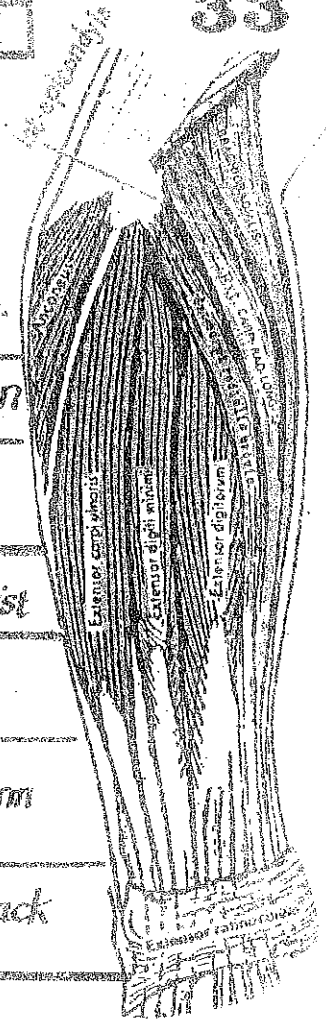
Muscle	Identifying feature(s):
1- Flexor pollicis longus	a unipennate m. on the lat. side (attached to the radius) if you pull its tendon → flexion of the thumb.
2- Flexor digitorum profundus	a thick m. on the med. side (attached to the ulna) It gives rise to 4 tendons in front of the wrist.
3- pronator quadratus	a quadrangular m. in the lower 1/4 of front of forearm.



SUPERFICIAL MUSCLES OF BACK OF FOREARM

They are 7 muscles which are identified from lat. to med. as follows:

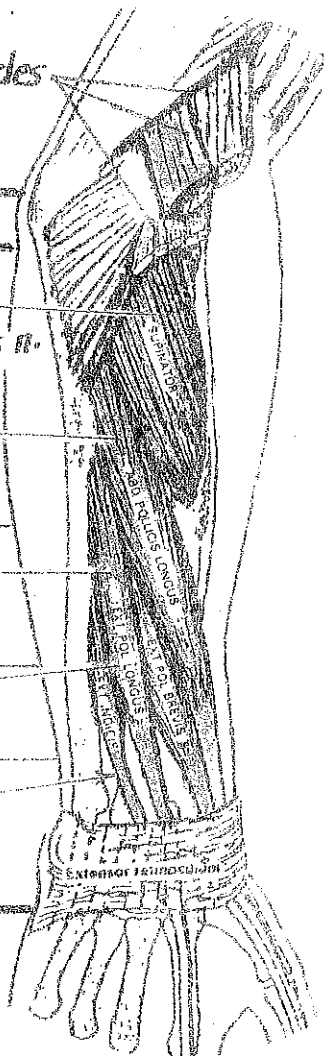
Muscle	Identifying feature(s)
(1) Brachioradialis	the lateral most & the highest m. of this group. It also appears on the front of forearm (lat. to pronator teres m.).
(2) Ext. Carpi radialis longus	lies just med. to brachioradialis & has long flat tendon
(3) Ext. Carpi radialis brevis	" " " " ext. carpi rad. longus & has a shorter flat tendon.
(4) Ext. digitorum	lies med. to ext. carpi radialis brevis & gives 4 tendons above wrist
(5) Extensor digiti minimi	lies med. to ext. digitorum & adherent to it in the upper part but develops a separate tendon in the lower part.
(6) Ext. Carpi ulnaris	the most medial muscle superficial muscles of back of forearm & is attached to the ulna.
(7) Anconeus	a small triangular m. at the upper part of med. side of back of forearm.



DEEP MUSCLES OF BACK OF FOREARM

They are 5 muscles which appear after retraction of the superficial muscles & are identified from lat. to medial as follows

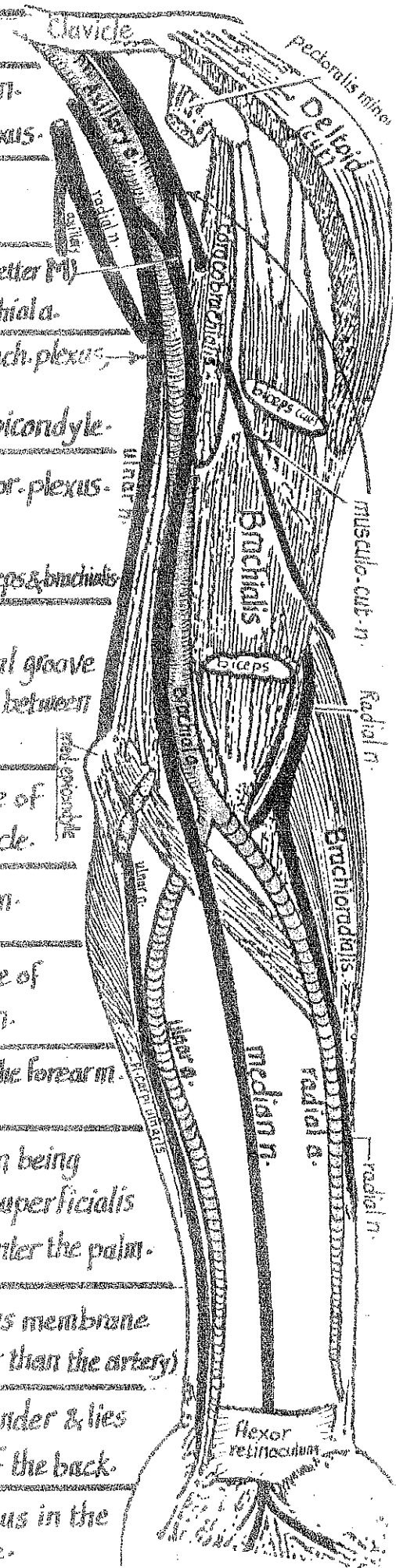
Muscle	Identifying feature(s)
1- Supinator	- it is the uppermost muscle of the deep group. - it is covered by white aponeurosis & pierced by post. interosseous n.
2- Abd. pollicis longus	- lies below & med. to the supinator muscle - its tendon crosses the lat. aspect of wrist obliquely.
3- Ext. pollicis brevis	- lies below & med. to the abductor pollicis longus - its tendon is closely related to that of abd. pollicis longus.
Ext. pollicis longus	- it lies med. to ext. pollicis brevis
4- Ext. indicis	- its tendon is the most med. one of the deep group - if you pull the tendon → extension of index finger.



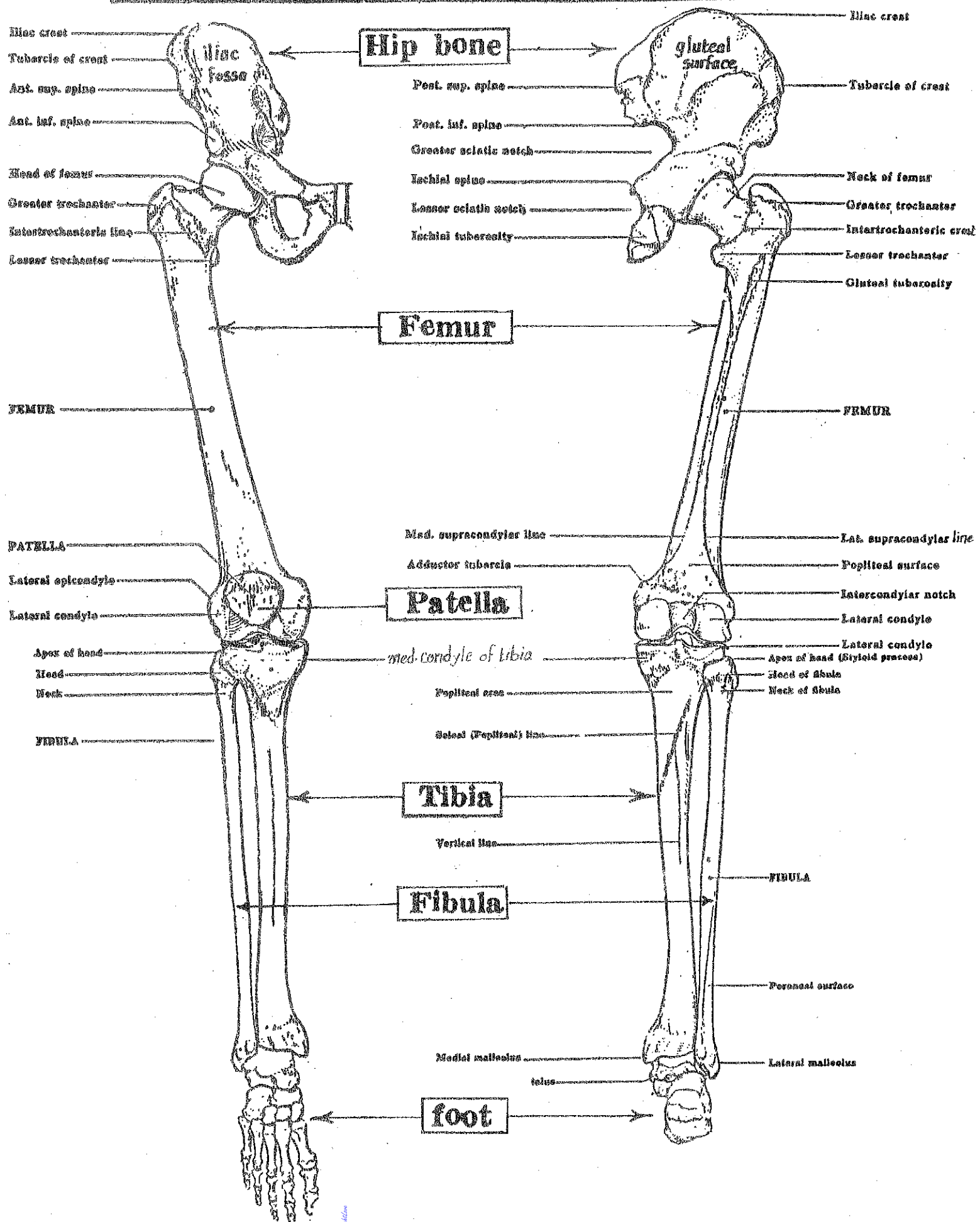
VESSELS AND NERVES

34

structure	Identifying feature(s)
Axillary a.	- a large vessel (collapsible) in the axilla & upper arm. - It is surrounded by the cords & brs. of the brach. plexus.
Brachial a.	the downward continuation of axillary a. in the arm (below the teres major m.).
Median n. in the arm	arises in the axilla by 2 roots (forms the middle limb of letter M) & descends to the cubital fossa, where it lies med. to brachial a.
ulnar n. in the arm	- arises in the axilla as the largest br. of med. cord of brach. plexus. - it forms the medial limb of the letter M - It descends down to reach the back of the med. epicondyle.
Musculo- Cutaneous n.	- arises in the axilla as the largest br. of lat. cord of br. plexus. forming the lateral limb of the letter M. - it pierces coracobrachialis then descends between biceps & brachialis
Radial n. in the arm	- arises as the largest br. of post. cord in axilla. - in the middle $\frac{1}{3}$ of arm it is identified in the spiral groove - " " lower $\frac{1}{3}$ " " " " " " " " groove between brachialis & brachioradialis muscles.
Radial a.	- the only vessel descending along the radial (lat.) side of front of forearm under cover of brachioradialis muscle.
Radial n. (in forearm)	descends along the lat. side of radial a. in the forearm.
ulnar a.	- the only vessel descending along the ulnar (med.) side of front of forearm under cover of flexor carpi ulnaris m.
ulnar n. (in forearm)	descends along the ulnar (med.) side of ulnar a. in the forearm.
Median n. (in forearm)	it descends along the middle line of front of forearm being adherent to the deep surface of flexor digitorum superficialis m. then passes deep to the flexor retinaculum to enter the palm.
Ant. inteross. nerve	a slender n. descending in front of the interosseous membrane (accompanied by ant. interosseous a. which is larger than the artery)
post. Inteross. nerve	the only n. found in the back of forearm. It is slender & lies between the superficial & deep group of muscles of the back.
Axillary nerve	the 2nd terminal br. of post. cord of brachial plexus in the axilla. It passes through the quadrangular space.

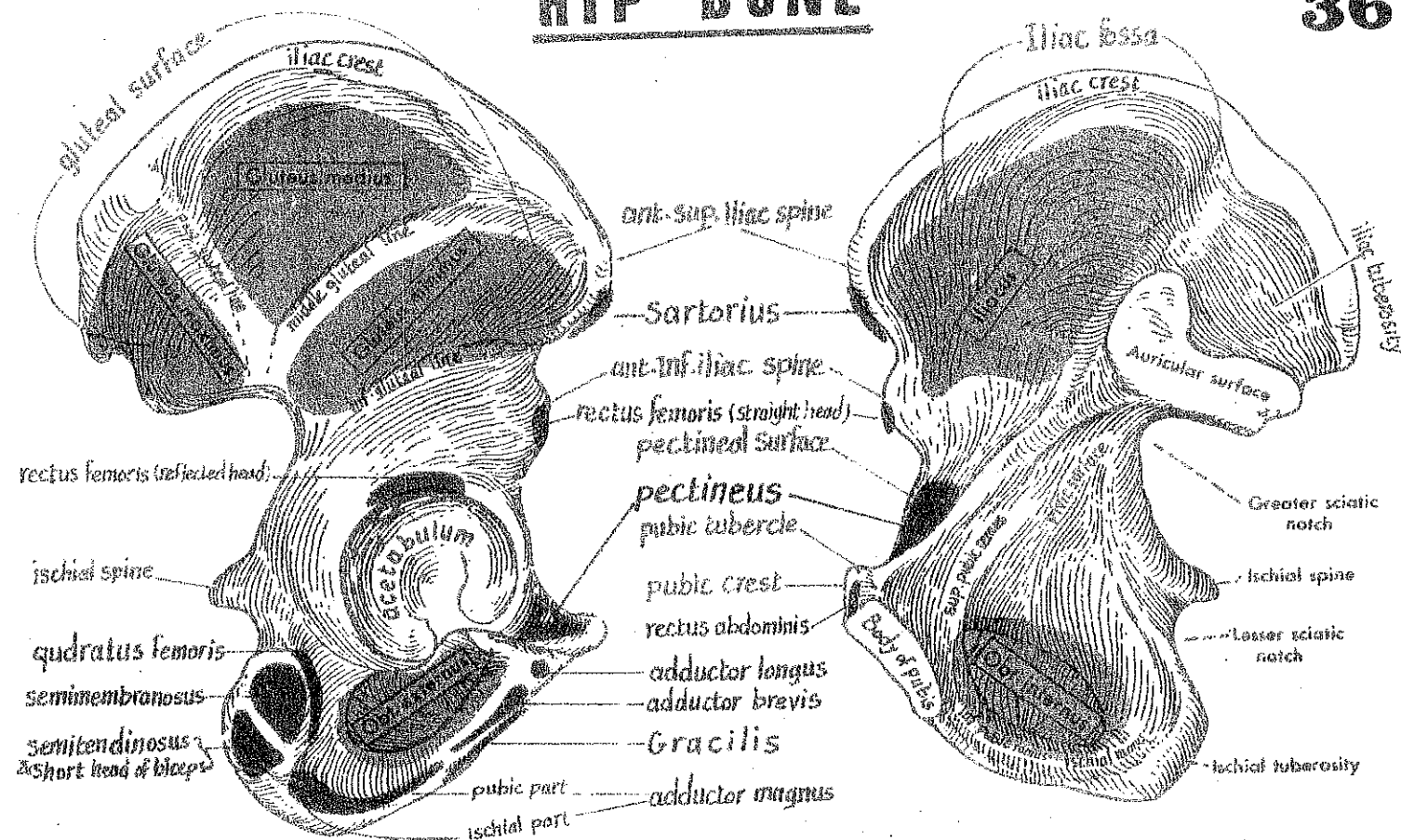


BONES OF THE L.L.



HIP BONE

36



* It is formed by fusion of 3 bones

- (1) ilium (above).
- (2) pubis (below).
- (3) ischium (behind).

Ilium : has :

- body : forming the upper 2/5 of the acetabulum.
- 3 borders : (a) ant. (b) post. (c) superior (iliac crest).
- 3 surfaces : (a) iliac fossa (b) sacro pelvic surface (c) gluteal surface.

(2) Ischium : has :

- body : forming the post. 2/5 of the acetabulum.
- Ischial spine : separating the greater sciatic notch from lesser sciatic notch.
- ischial tuberosity : gives origin to the hamstring muscles.
- ischial ramus : joins the inf. pubic ramus to form conjoined ischio pubic ramus.

(3) pubis : has :

- body : its upper border forms the pubic crest which ends laterally by pubic tubercle.
- sup. ramus : reaches the acetabulum forming its ant. 1/5.
- inf. ramus : joins the ischial ramus.

Surgical importance

fracture hip occurs most commonly due to crushing force & leads to fracture of ala of ilium & the conjoined ischio-pubic ramus.



FEMUR

37

- * It is the longest & strongest bone in the body.
- * It consists of upper end, shaft & lower end.

1. Upper end: consists of

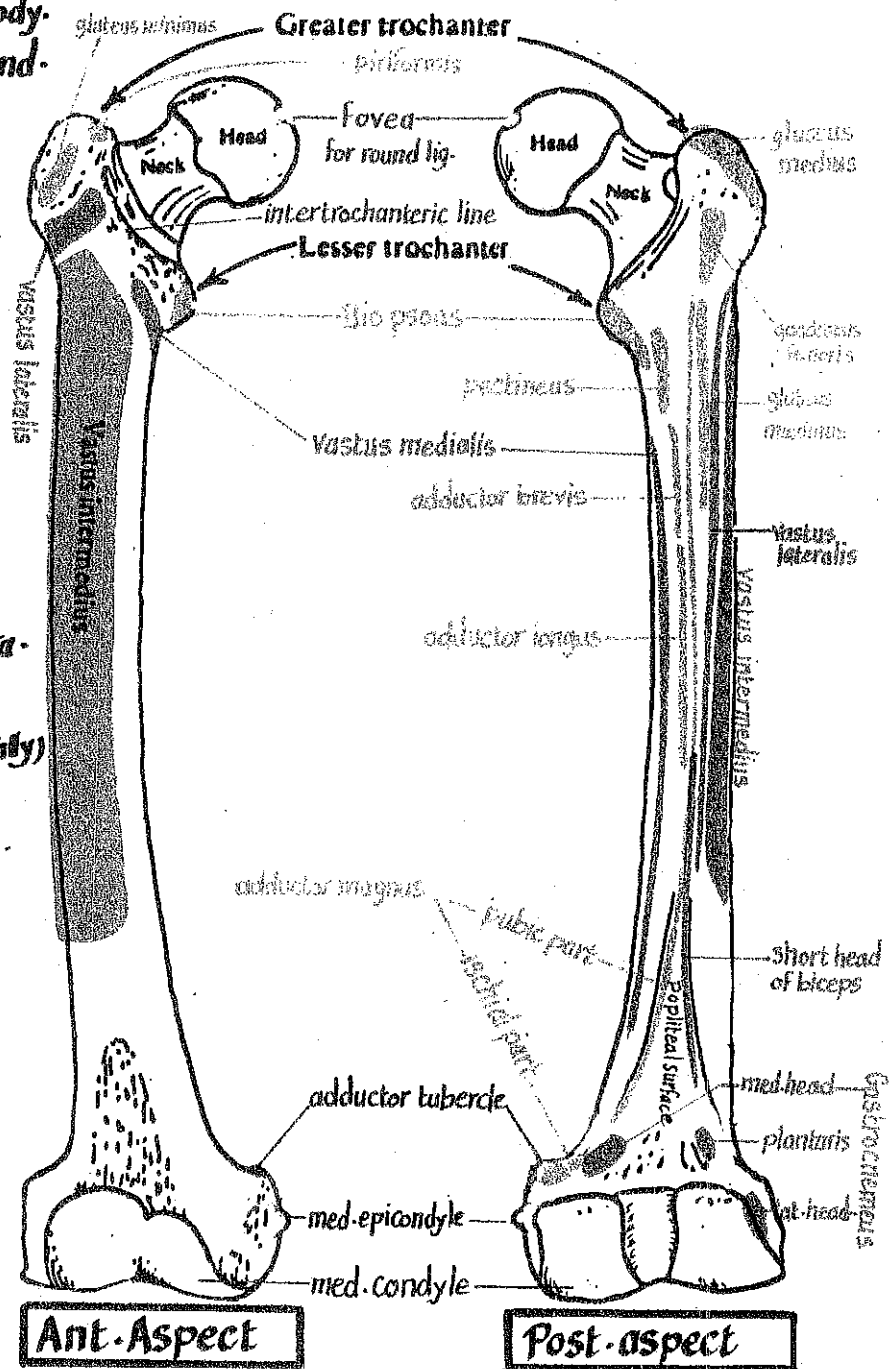
- (a) head: has a fovea for the round lig.
 - (b) neck: forming an angle of 120° with shaft.
 - (c) greater trochanter: projecting laterally.
 - (d) lesser trochanter: projecting posteromed.
- N.B.: the 2 trochanters are connected anteriorly by intertrochanteric line

2. Shaft:

- has 3 surfaces (ant., medial & lateral)
- its post. border is thick & called *linea aspera*.
- the post. aspect of the upper $\frac{1}{4}$ shows spiral line (medially) & gluteal tuberosity (laterally)
- the post. aspect of the lower $\frac{1}{4}$ shows popliteal surface between the med. & lat. supracondylar ridges.

3. Lower end: shows:

- (a) 2 condyles (med. & lat.)
- (b) 2 epicondyles (lat. & med.) on the outer aspect of the 2 condyles
- (c) adductor tubercle: at the lower end of the med. supracondylar ridge.

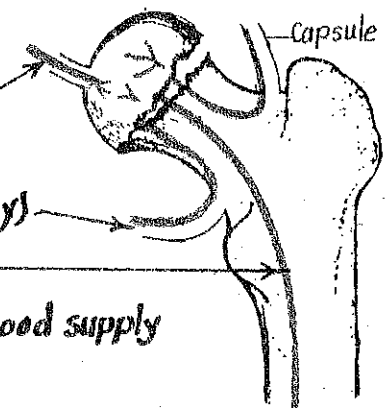


SURGICAL IMPORTANCE

(A) Blood Supply of the head of Femur: from 3 sources

- (1) an artery in the round lig. of the head (little supply)
- (2) the retinacular vessels in the reflected part of Capsule (main supply)
- (3) ascending br. of the nutrient a. in the shaft

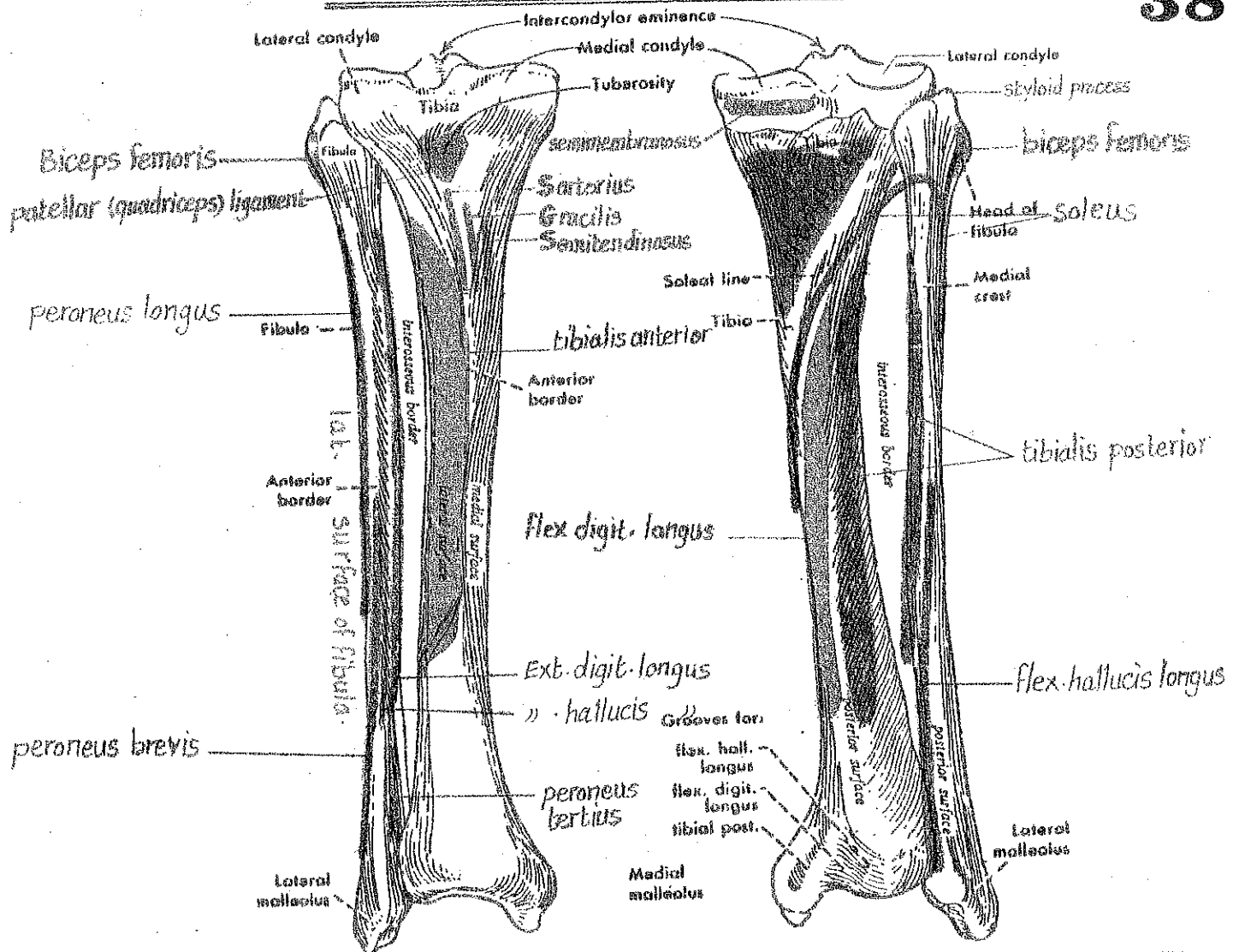
N.B.: High fracture of the neck leads to interruption of the main blood supply of the head → **Avascular necrosis**.



- (B) The adductor tubercle lies at the level of the epiphyseal cartilage of the lower of femur (it should not be touched in surgical operations otherwise arrest of growth of the bone will occur because the lower end of the femur is the growing end)

Tibia and Fibula

38



	Tibia	Fibula
Upper End	Formed of 2 condyles (med. & lat.) & tibial tuberosity	Formed of styloid process, head & neck.
Shaft	- has 3 borders & 3 surfaces - anterior - interosseous - medial - lateral - posterior	- has 3 borders & 3 surfaces - anterior - interosseous - posterior - medial - lateral
Lower End	large & projects down medially forming the Medial malleolus	- smaller than that of the tibia & is called Lateral malleolus.
SURGICAL IMPORTANCE	(1) it is liable to fracture as its med. surface & ant. border are subcutaneous. The fracture is usually compound & in the lower $\frac{1}{3}$ (slender) (2) the upper end of tibia is one of the common sites of acute osteomyelitis. Knee joint usually escapes as the site of infection is extra capsular.	(1) Fibula is an ideal spare bone for grafting (it is not weight-bearing). (2) the lower end of Fibula is fractured spirally in 1st stage of Pott's fracture. (3) lat. popliteal n. can be rolled against the neck of Fibula & is liable to injury in fracture neck.

THE BONES OF THE FOOT

dorsal aspect

plantar aspect

39

The foot is constructed of 3 parts : tarsus, metatarsus & phalanges

THE TARSUS

Consists of the following 7 bones :

- (1) Talus : the top bone of the tarsus.
- (2) Calcaneus : below talus & is the largest bone
- (3) Cuboid : between calcaneus & lat. 2 metatarsals
- (4) Navicular : between the head of talus & the 3 cuneiform bones
- (5) 3 Cuneiform bones : med., intermediate & lat.

THE METATARSUS

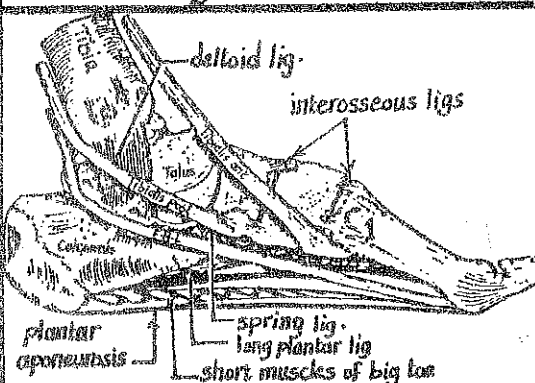
They are 5 bones arranged as 1st, 2nd, 3rd, 4th & 5th from med. to lateral.

THE PHALANGES

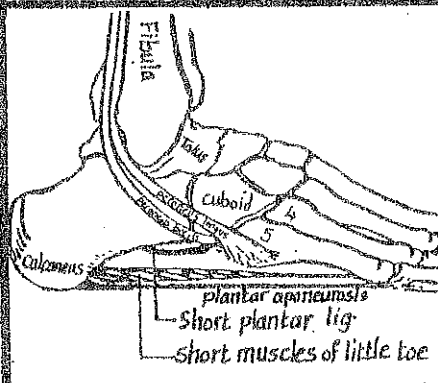
are the bones of the toes. Each toe has 3 phalanges except the big toe which has only 2 (proxim & distal).

THE ARCHES OF THE FOOT

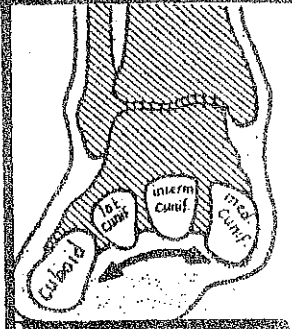
Med. Longitudinal arch



Lat. Longitudinal arch



Transverse arch



Construction	9 bones { Calcaneus, talus, navicular the 3 cuneiform bones med. 3 metatarsal bones	4 bones { calcaneus cuboid lat. 2 metatarsals	- cuboid bone, the 3 cuneiforms & bases of the metatarsal bones
Function	it is a high arch concerned with the elastic propulsion of foot during walking.	it is a low arch concerned mainly with body weight transmission.	- it is concerned with elastic propulsion of foot & body weight transmission
Factors Maintaining	A-Ligaments : (1) plantar aponeurosis. (2) long plantar lig. (3) interosseous ligaments. (4) deltoid & spring B-Muscles : (1) tibialis ant. & post. mm. (2) Flexor hallucis longus. (3) short muscles of big toe.	A-Ligaments : (1) plantar aponeurosis (2) short plantar lig. (3) interosseous lig. B-Muscles : (1) peroneus longus & brevis & tertius mm. (2) short mm. of little toe.	A-Ligaments : - plantar interosseous lig. (3) Muscles : (1) peroneus longus (2) tr. head of add. hallucis

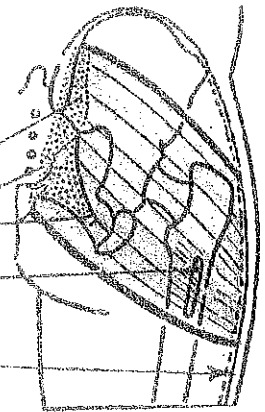
MUSCLES OF THE L.L

40

I. gluteal muscles.

(1) GLUTEUS MAXIMUS M.

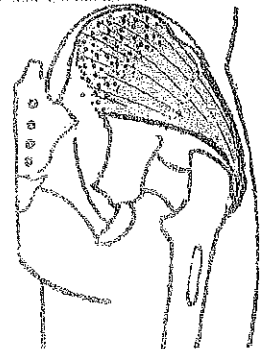
- * Origin : (1) gluteal surface of ilium behind post-gluteal line
(2) back of sacrum & sacrotuberous ligament
- * Insertion : (1) gluteal tuberosity of femur
(2) iliotibial tract
- * N. supply : inf. gluteal n.
- * Action : (1) main extensor of hip. (2) lat. rotator of thigh.
- * S. importance : paralysis of gl. maximus → inability to stand from sitting position.



GLUTEUS MAXIMUS M.

(2) GLUTEUS MEDIUS M.

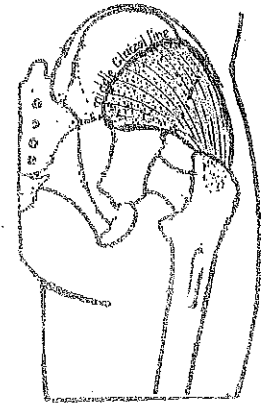
- * O : gluteal surface, between post. & middle gluteal lines.
- * INS : lat. surface of greater trochanter of femur.



GLUTEUS MEDIUS

(3) GLUTEUS MINIMUS M.

- * O : gluteal surface, between middle & inf. gluteal lines.
- * I : ant. surface of greater trochanter of femur.
- * N. supply of gluteus medius & minimus : sup. gluteal n.
- * Action : " " " " " :
(1) abduction of the hip joint.
(2) medial rotation of the thigh.
(3) they maintain the balance of the body when the opposite foot is off the ground by exerting a powerful traction on the hip bone on the same side thus preventing the tilt of the pelvis towards the opposite side.



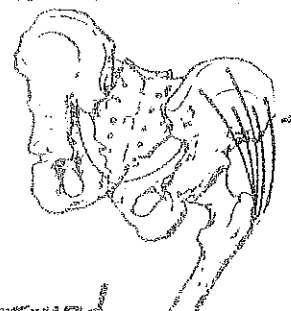
GLUTEUS MINIMUS

* Surgical importance of gluteus medius & minimus :

- (1) paralysis of both muscles leads to Waddling gait.
- (2) the integrity of " " can be assessed clinically by the

Trendelenburg test as follows :

- the patient stands on one leg, with the other leg is off the ground:
- (a) if the muscles of the supported side are normal, the pelvis rises slightly on the opposite side
- (b) if the muscles of the supported side are paralysed, the pelvis sinks on the opposite side (+ve Trendelenburg test).



Normal



+ve Trendelenburg

MUSCLES OF THE FRONT OF THIGH

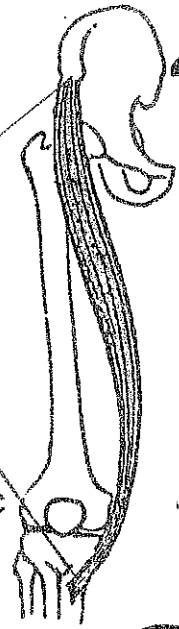
41

- they include : sartorius & quadriceps femoris
- they are all supplied by Femoral n.

(1) Sartorius:

- * Origin : from the ant. sup. iliac spine (A.S.I.S)
- * Insertion : upper part of med. surface of tibia.
- * Action : putting the lower limb in the classical cross-leg position as follows :
 - (1) Flexion, abduction & lat. rotation of thigh
 - (2) Flexion & medial rotation of the leg.

Classical
tailor (sartor)
Position

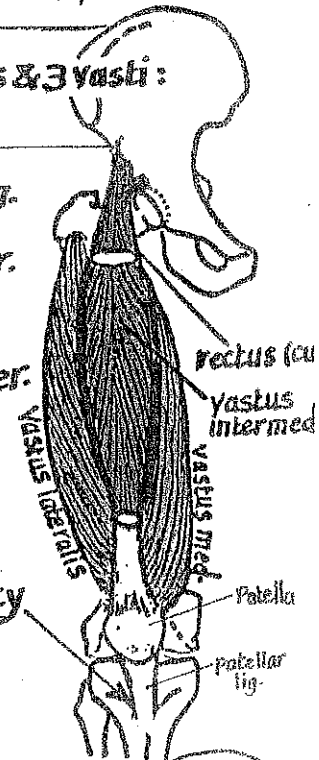


(2) Quadriceps femoris : it is formed of 4 heads : rectus femoris & 3 vasti :

- * Origin :
 - (1) rectus femoris : straight head : ant. inf. iliac spine. reflected : groove above acetabulum.
 - (2) vastus intermedius : upper 3/4 of ant. & lat. surfaces of femur.
 - (3) vastus lateralis : lat. lip of linea aspera & its extension upwards to the base of the greater trochanter.
 - (4) vastus medialis : med. lip of linea aspera & its extension upwards to the spiral line.

- * Insertion : by a common tendon into the patella then extends as patellar ligament which is inserted into tibial tuberosity

- * Action : - the whole muscle is the main extensor of the knee.
- the rectus femoris is also a powerful flexor of the hip joint.



MUSCLES OF THE MEDIAL SIDE OF THE THIGH

(The Adductor group)

* General remarks :

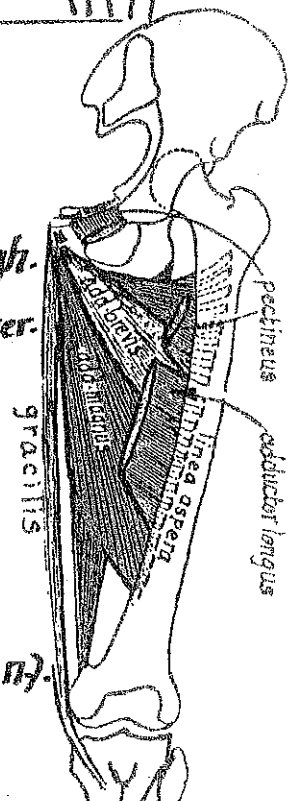
- The are arranged as follows :
 - gracilis : the most medial muscle in the thigh.
 - adductor longus & pectineus : forming the ant. layer.
 - adductor brevis : forming the middle layer
 - adductor magnus : " " post. layer

- * Origin : all arise from pubis (body, sup. ramus & inf. ramus)

- * Insertion : all are inserted into the back of femur (linea aspera & its extension) except gracilis which is inserted into the tibia.

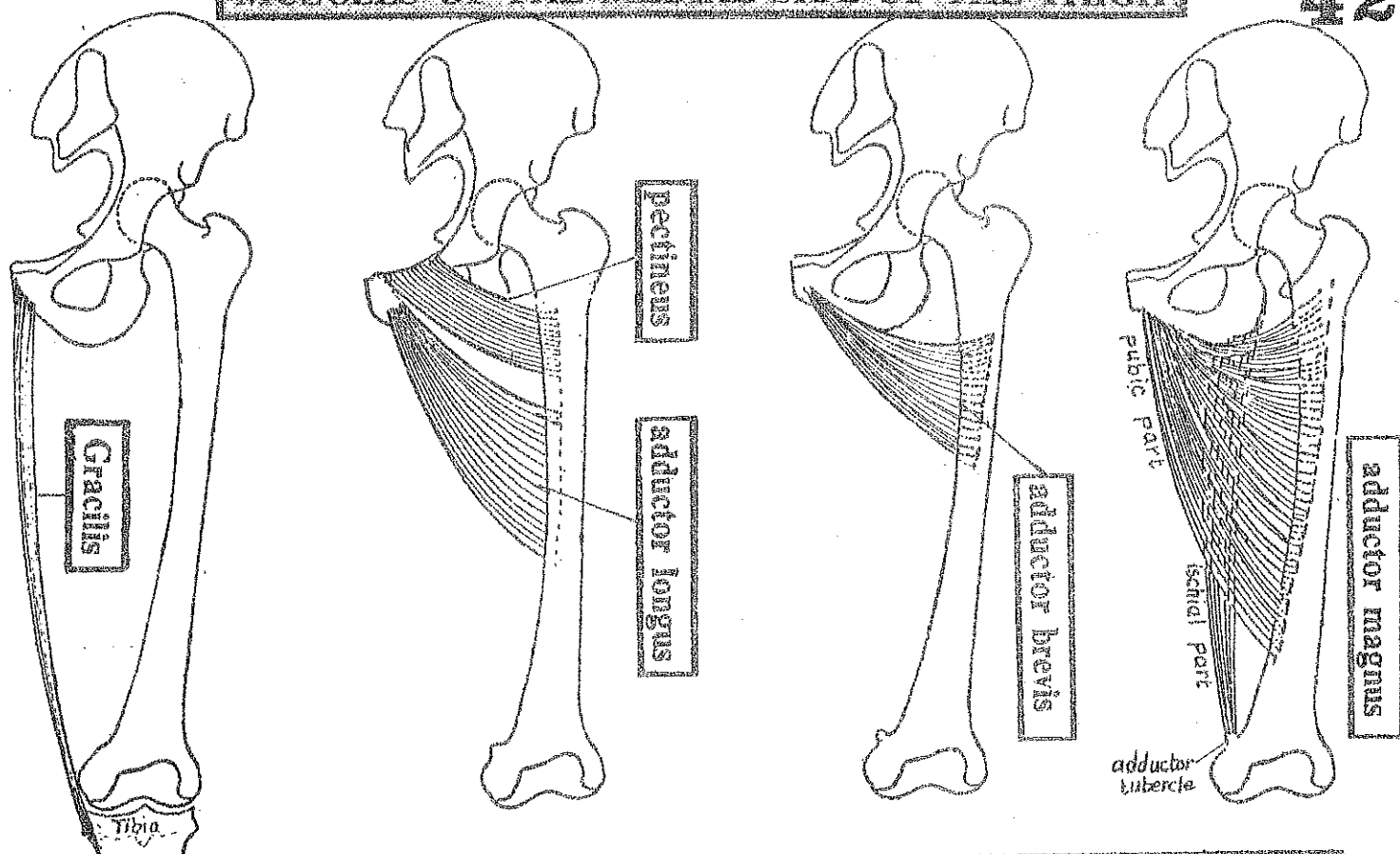
- * N. supply : all are supplied by obturator n. except pectineus (by femoral n.).

- * Action : all are adductors of hip joint.



MUSCLES OF THE MEDIAL SIDE OF THE THIGH

42



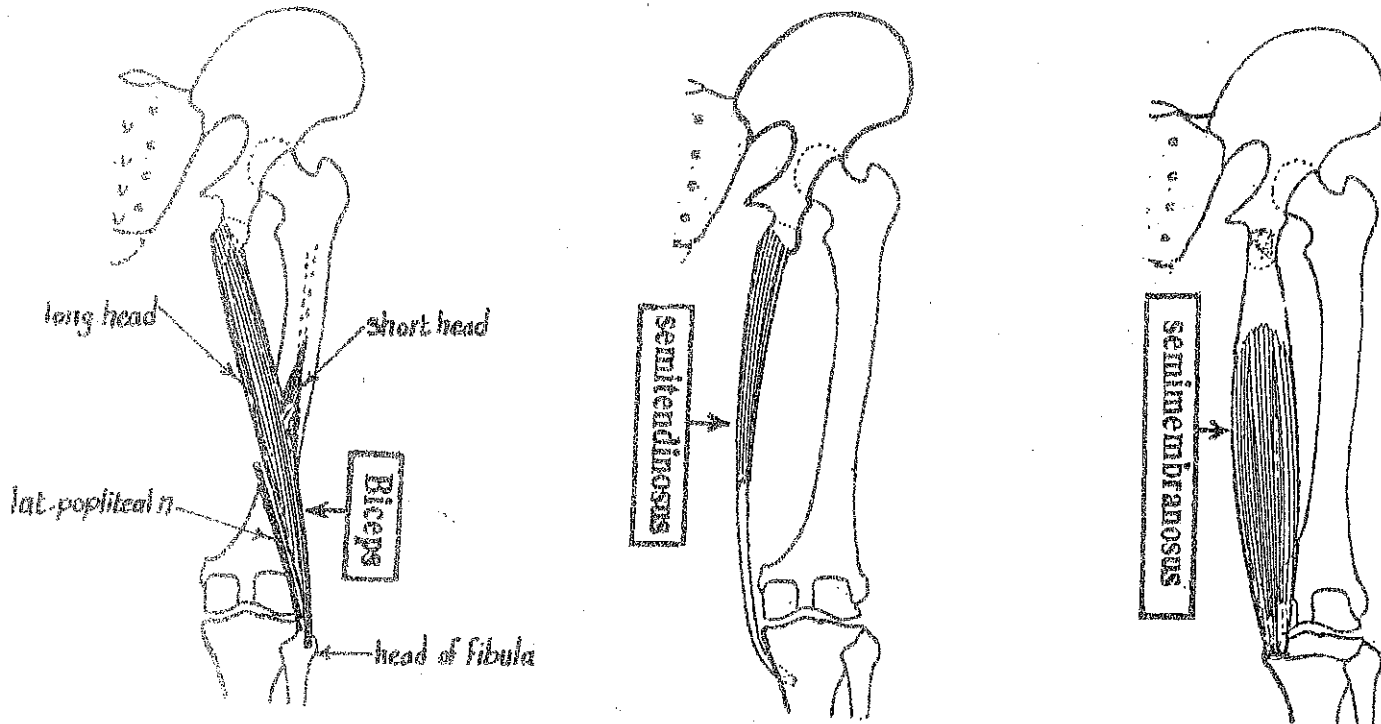
Muscle	Origin	Insertion	N.S.	ACTION
Gracilis	body of pubis & inf. pubic ramus close to the symphysis pubis	upper part of med. surface of tibia behind the sartorius	Obturator foramen	(1) adduction of thigh (2) flexion & med. rotation of leg.
Pectineus	pectineal surface & line of sup. pubic ramus	pectineal line of femur	Femoral foramen	(1) adduction of thigh. (2) flexion of thigh.
Adductor Longus	body of pubis, just below pubic tubercle.	linea aspera of femur	Obturator foramen	adduction, flexion & lat. rotation of thigh.
Adductor brevis	pubic body & inf. pubic ramus	linea aspera & lower part of pectineal line	Obturator foramen	adduction, flexion & lat. rotation of thigh.
Add. magnus	(a) Pubic part	conjunct ischio-pubic ramus	Obturator foramen	adduction & lateral rotation of thigh
	(b) Ischial part	lower part of the ischial tuberosity.	Obturator foramen	extension of hip.

* Surgical Importance :

The spasm of the adductors of the thigh (in certain intractable cases of spastic paraplegia) can be relieved by surgical division of the obturator n.

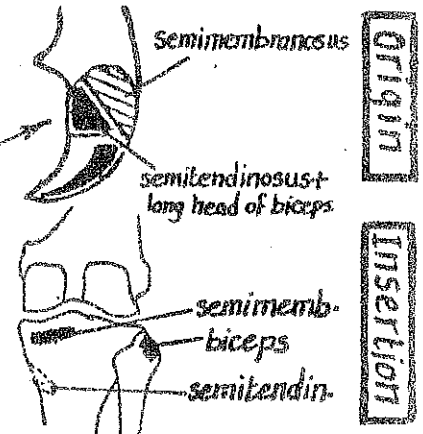
MUSCLES OF THE BACK OF THE THIGH

43



* General remarks:

- They include 3 muscles
 - (1) biceps femoris (laterally)
 - (2) semitendinosus (medially)
 - (3) semimembranosus (medially)
- Origin: all arise from the ischial tuberosity
- Insertion: into upper end of tibia & fibula
- N. supply: all are supplied by sciatic n.
- Action: extension of hip & flexion of knee.



Muscle	Origin	Insertion	ACTION
(1) Biceps - short head - long head	- linea aspera of femur. - lower med. area of upper part of ischial tuberosity.	Head of fibula	(1) extension of hip (2) flexion of knee. (3) lat. rotation of leg.
(2) Semitendinosus its lower part is tendon	lower med. area of upper part of ischial tuberosity in common with l-h of biceps	upper part of med. surface of tibia.	(1) extension of hip. (2) flexion of knee.
(3) Semimembranosus its upper part is a membrane	upper lat. area of the upper part of ischial tuber.	mainly into the back of med. condyle of tibia	(3) med. rotation of leg

* Surgical importance :

- Contracture of the tendons of the above mentioned muscles is a common complication of certain knee joint diseases. This can be relieved by surgical division of the affected tendons. Injury of lat. popliteal n. should be avoided as it is closely related to med. border of biceps tendon.

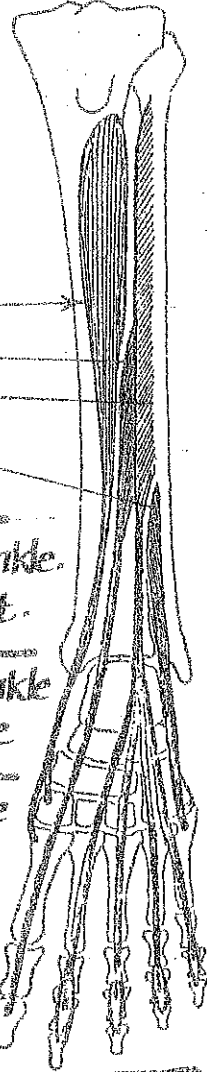
Muscles of Front leg (Extensors or Dorsiflexor)

* General remarks

- They arise from tibia & fibula & are inserted in the bones of the foot.
- They are Supplied by the ant. tibial (deep peroneal) nerve.
- They have a common action : dorsiflexion (extension) of ankle joint.
- Their tendons cross in front of ankle joint

in the following order (from med. to lat.):

- (1) Tom : Tibialis anterior
- (2) Has : ext. Hallucis longus
- (3) Dog : ext. Digitorum longus
- (4) Pig : Peroneus tertius



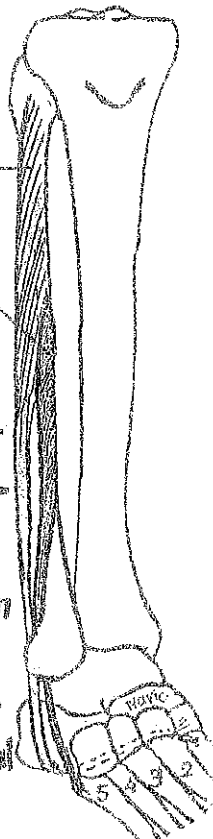
Muscle	Origin	Insertion	ACTION
1- Tibialis ant.	upper 1/2 of lat. surface of tibia + inteross. memb	med. cuniform + base of 1st metatarsal bone	- extend the ankle. - invert the foot.
2- Ext. hallucis longus	middle 2/4 of ant. surface of fibula	base of terminal phalanx of the big toe.	- extend the ankle - " big toe
3- Ext. digit. longus	upper 3/4 of the ant. surface of fibula.	by 4 tendons into the extensor expansions of the lat. 4 toes.	- extend ankle - extend the lat. 4 toes.
4- peroneus tertius	lower 1/4 of the ant. surface of fibula	base of the 5th metatarsal bone.	- extend ankle. - evert foot.

Muscle of lat. Aspect of leg. (Evertors)

General remarks:

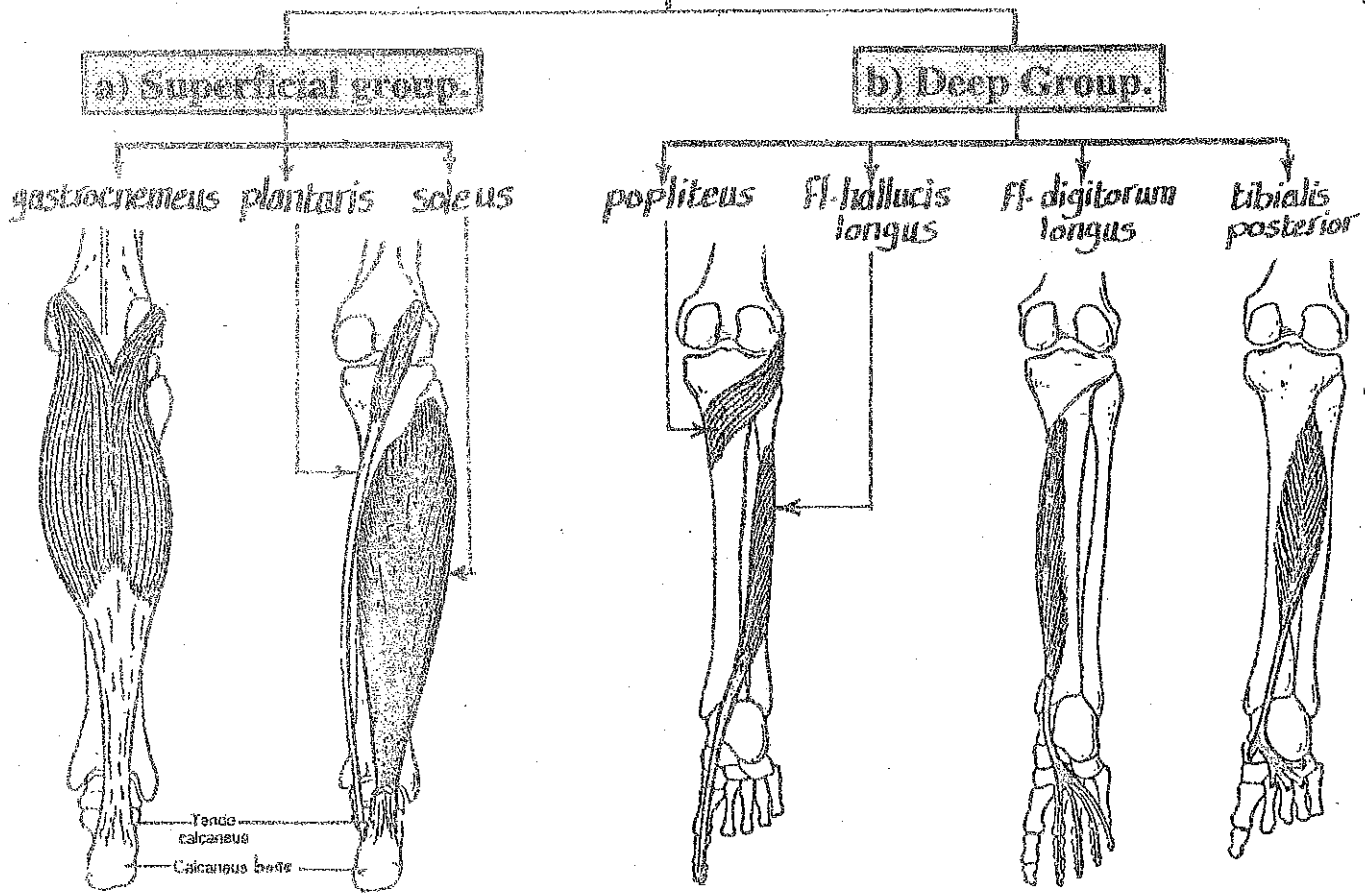
- they include 2 muscles arising from lat. surface of fibula
- their tendons pass behind the lat. malleolus.
- they are supplied by the musculocutaneous n.
- they have a common action : eversion, plantar flexion of foot + maintaining the lat. longitudinal arch.

peroneus longus
peroneus brevis



Muscle	Origin	Insertion	ACTION
1- Peroneus longus	upper 2/3 of the lat. surface of fibula.	med. cuniform & base of 1st metatarsal bone	- plantar flexion - eversion.
2- peroneus brevis	lower 2/3 of the lat. surface of fibula.	tuberosity of the 5th metatarsal bone.	- maintain the lat. longitudinal arch.

Muscles of back of leg (flexors or plantar flexors)



Muscle	Origin	Insertion	N.S.	ACTION
Gastrocnemius	(a) lat. head: lat. surface of lat. condyle of femur (b) med. head: popliteal surface of femur above med. condyle.	the 3 muscles join the tendo-achilis which is inserted into the middle of post. surface of Calcaneus	medial popliteal nerve N.B. soleus receives also br from post. tibial n.	- they are the chief Planter Flexors of the ankle joint - the gastrocnemius can also flex the knee
Soleus	(a) upper 1/3 of post. surf. of fibula (b) tendinous arch between tibia & fibula (c) middle 1/3 of med. border of tibia			
plantaris	popliteal surface of femur above the lat. condyle.			
Popliteus	lat. surface of lat. condyle of femur	post. surface of tibia above the soleal line	Post. tibial n.	med. rotation of knee at the beginning of flexion (unlocking)
Flexor hallucis longus	post. surface of fibula	base of terminal phalanx of big toe.		- flexes the ankle & big toe. - maintains med. longitudinal
Flexor digit. longus	post. surface of tibia below the soleal line.	4 tendons into bases of terminal phalanges		- flexes ankle & lat. 4 toes
Tibialis post.	Post. surface of tibia, fibula & the interosseous memb.	into all tarsal bones except the talus		Flexes the ankle & inverts foot.

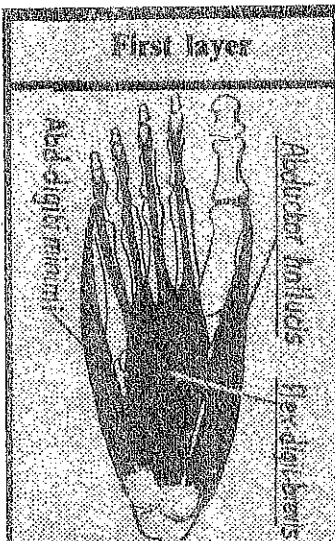
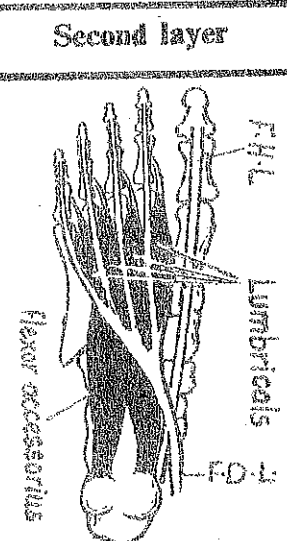
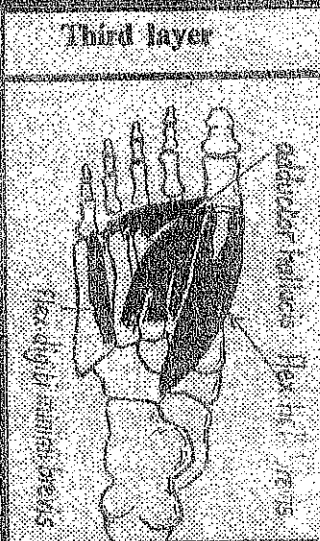
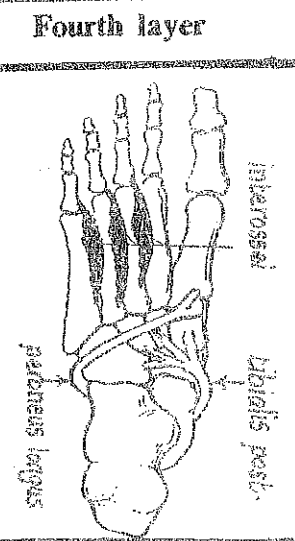
*** Surgical importance**

- (1) Soleus contains a large valveless venous plexus which is pumped out by the contraction of the muscle.
- (2) It has double nerve supply. Both nerves should be cut in surgical treatment of intermittent claudication.

Layers of The Sole Of the Foot

46

(MUSCLES AND TENDONS OF THE SOLE OF THE FOOT)

	First layer	Second layer	Third layer	Fourth layer
				
Muscles	3 muscles: (1) abductor hallucis (2) flex. digit. brevis (3) abd. digiti minimi	2 muscle (1) flex. digit. accessorius (2) lumbrical muscles (4)	3 muscles (1) adductor hallucis (2) flexor hallucis brevis (3) flex. digiti minimi brevis	2 muscles (1) plantar interossei (2) dorsal "
Tendons		2 tendons (1) flexor hallucis longus (2) " digitorum "		2 tendons (1) peroneus longus (2) tibialis post.

LYMPHATIC DRAINAGE OF LOWER LIMB

(A) Superficial Lymphatics : follow the superficial veins (long & short saphenous).

(B) Deep Lymphatics : follow the arteries of the lower limb.

- Finally, all lymphatics of the L.L. end in the superficial & deep inguinal L.N.

(I) Superficial inguinal L.Ns.

- lie in the superficial fascia of femoral Δ & are T-shaped formed of 2 sets:

(A) Horizontal Set : lie below inguinal lig. & include 2 groups (lat. & med.)

(1) lateral group : lying below the lateral part of the inguinal lig.

- They drain the buttock & post. abd. wall below the waist

(2) medial group : lying below the medial part of the inguinal lig.

- they drain the perineum & ant. abd. wall below umbilicus.

(B) Vertical Set : lie along the lat. side of the great saphenous vein

- they drain all superficial structures of the L.L.

(II) Deep inguinal L.Ns.

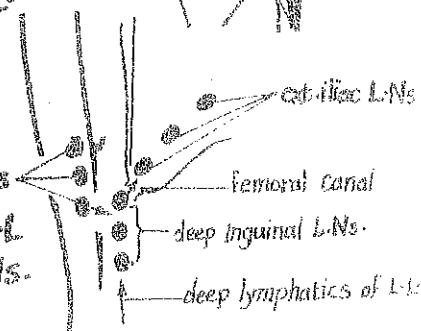
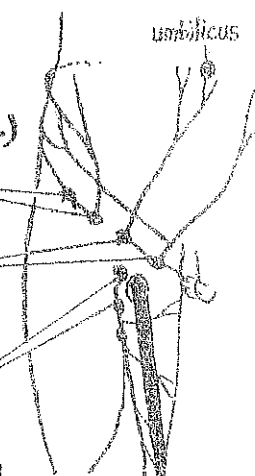
- lie in the femoral Δ along the med. side of the femoral vein.

- they receive afferent lymphatics from (a) superficial inguinal L.Ns

(b) all deep lymphatics of L.L.

(c) efferents of popliteal L.Ns.

- they send efferents to the external iliac L.Ns in the abdomen

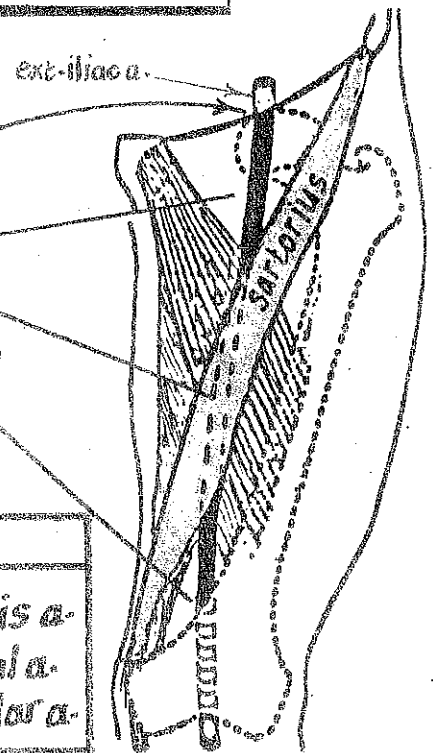


ARTERIES OF THE L.L

47

FEMORAL ARTERY

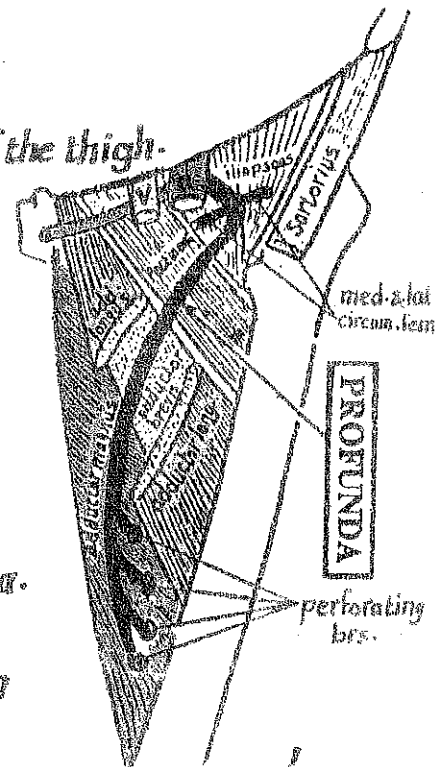
- * **Beginning** : behind the inguinal lig. at the midinguinal point as a continuation of external iliac artery.
- * **Course** : - its upper $\frac{1}{2}$ lies superficial in the femoral triangle.
- its lower $\frac{1}{2}$ lies deep in the subsartorial canal.
- * **Termination** : at the junction of upper $\frac{2}{3}$ & lower $\frac{1}{3}$ of thigh by passing through the opening in adductor magnus m. to become the popliteal artery.



* Branches :	Superficial branches	Deep branches
(1)	superficial epigastric a.	(1) Profunda femoris a.
(2)	ext. pudendal	(2) deep ext. pudendal a.
(3)	circumflex iliac a.	(3) descending genicular a.

PROFUNDA FEMORIS ARTERY

- It is the largest br. of femoral a. & is the main blood supply of the thigh.
- arises from the femoral a. 4 cm. below the inguinal ligament.
- it leaves the femoral Δ by passing deep to adductor longus.
- it descends on adductor brevis then adductor magnus muscles.
- it ends by becoming the 4th perforating a.
- it gives the following branches : (1) med. circumflex femoral a.
(2) lat. " " "
(3) 4 perforating branches.



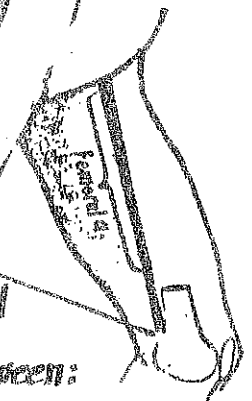
- N.B.** : - Common femoral a. : is the part of femoral a. above the profunda.
- deep femoral a. : is the synonym of the profunda femoris a.
- Superficial femoral a. : is the part of femoral a. below the origin of the profunda a.

* Surface anatomy of femoral a. :

- It is represented by the upper $\frac{2}{3}$ of a line connecting the following 2 points :
(1) midinguinal point (midway between AS.I.S & Symphysis pubis).
(2) adductor tubercle (at the lower end of the tendon of add. magnus m.)

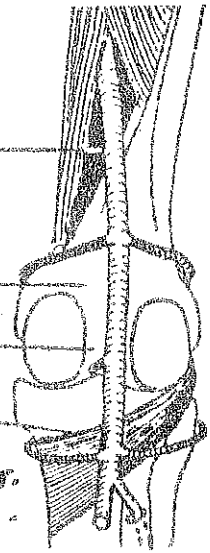
* **Surgical importance** after ligature of femoral a. in the subsartorial canal, the collateral circulation is established through the anastomosis between :

- (1) descending br. of lat. circumflex femoral br. of profunda & descending genicular br. of femoral a.
- (2) 4th perforating br. of profunda & the muscular brs. of the popliteal a.



POPLITEAL ARTERY

- * Begins: as a continuation of femoral a. at the adductor hiatus
- * Course: it descends as the deepest structure in the popliteal fossa, lying on:
 - (1) popliteal surface of femur
 - (2) back of capsule of knee joint
 - (3) fascia covering popliteus muscle
- * Ends: at the lower border of popliteus m. by dividing into 2 terminal brs.: ant. & post. tibial arteries.
- * Branches: (1) muscular brs. (2) genicular brs.
 - sup. & inf. med. genicular.
 - " & " lat. "
 - middle genicular a.
- * Surgical importance: popliteal a. is a common site of aneurysm because:
 - (1) constant pulsations of the artery against the underlying tendon of add. magnus may cause changes in the arterial wall.
 - (2) popliteal a. is fixed to the capsule of knee joint by a fibrous band just above the femoral condyles. This may be a source of continuous traction on the artery.



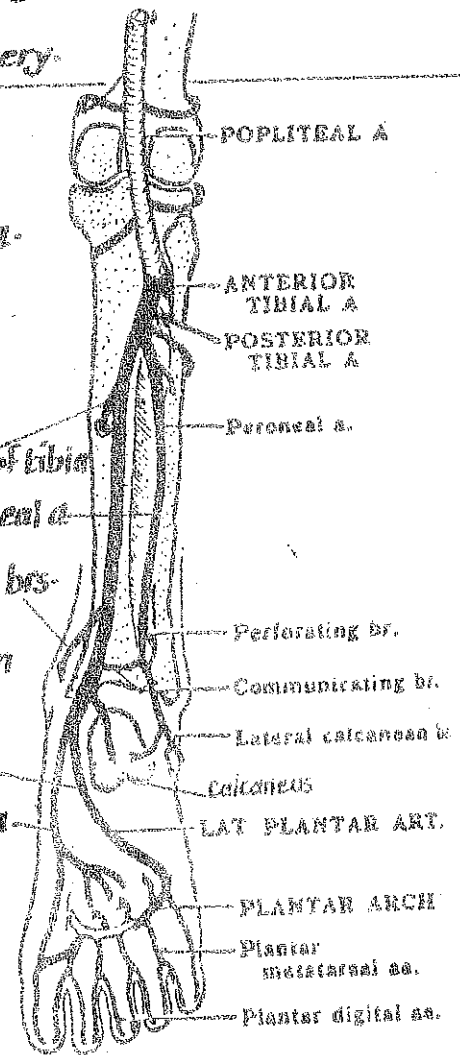
POSTERIOR TIBIAL A

- * Origin: arises as the larger of the 2 terminal brs. of popliteal a. at the lower border of popliteus m.
- * Course: it descends in the post. compartment of the leg, accompanied by post. tibial n., between the superficial & the deep calf muscles.
- * Branches:
 - (1) muscular brs. & nutrient a. of tibia
 - (2) circumflex fibular & peroneal a.
 - (3) calcaneal & med. malleolar brs.

- * Termination: deep to the flexor retinaculum, midway between med. malleolus & calcaneal tuberosity by dividing into 2 terminal brs.: (1) lat. plantar a. (2) med. plantar a.

The peroneal a

- * It is the largest br. of post-tibial a. & is the main arterial supply of the calf
- * it arises 1" below the origin of the post-tibial a.
- * it descends downwards & laterally close to the fibula.
- * it gives the following brs.: (a) muscular brs. (b) nutrient a. of fibula (c) perforating br. which pierces the interosseous memb. 5 cm above ankle (may replace dorsalis pedis a.)
- * It ends behind the inf. tibiofibular joint by dividing into lat. calcaneal brs.



Posterior View

ANTERIOR TIBIAL A.

- * Beginns: at the lower border of popliteus m. as the smaller of the 2 terminal branches of popliteal artery.
- * Course: - it pierces the upper part of the interosseous membrane to reach the ant. compartment of leg where it descends accompanied with ant. tibial n. on the interosseous memb. then on ant. surface of the lower end of tibia.
- * Branches: (a) post. & ant. tibial recurrent arteries.
(b) muscular brs. to the ant. compartment of leg.
(c) ant. med. malleolar & ant. lat. malleolar arteries.
- * Termination: in front of ankle joint, midway between the 2 malleoli, by becoming the dorsalis pedis a.
- * N.B: blood supply to the ant. compartment of the leg is reinforced in the lower part by the perforating br. of the peroneal artery.

DORSALIS PEDIS A.

- * Beginns: as direct continuation of ant. tibial a. in front of ankle joint.
- * Course: it runs on the dorsum of foot between the tendon of ext. hallucis longus medially & ext. digitorum longus laterally then pierces the 1st dorsal interosseous muscle to reach the sole of foot.
- * Ends: in the sole by completing the plantar arterial arch.
- * Branches: med. & lat. tarsal arteries, 1st dorsal metatarsal a. & the arcuate a. (gives the 2nd, 3rd & 4th » aa).
- * N.B: In 15% of people the dorsalis pedis a. is absent & the arterial supply of the dorsum of foot is carried out by perforating br. of peroneal a.

Arteries of the sole

- 1) Lateral plantar a.:
 - beginns as the larger of the 2 terminal brs. of the post. tibial a. behind the med. malleolus.
 - ends by forming the plantar arch which ends by joining dorsalis pedis a. at the 1st interosseous space
 - branches: muscular, plantar metatarsal arteries & Med. Calcanean a. (supplies the heel flap of skin in modified Syme's amputation).
- 2) Med. plantar a.: arises as the smaller of the 2 terminal brs. of the post. tibial a. & runs along the med. side of the sole.



Collateral Circulation of the thigh

50

(1) Trochanteric anastomosis: (at the trochanteric fossa)

it is a rich anastomosis between the following arteries:

- (1) branch from sup. gluteal a.
- (2) " " inf. gluteal a. } from int. iliac a. in the pelvis.
- (3) ascending br. from both med. & lat. circumflex aa. of profunda.

(2) Cruciate anastomosis: on back of lesser trochanter of femur.

it is a rich anastomosis between:

- the transverse brs. of both med. & lat. circumflex brs. of profunda.
- descending br. from inf. gluteal a. (br. of int. iliac a.)
- ascending br. from the 1st perforating a. of profunda.

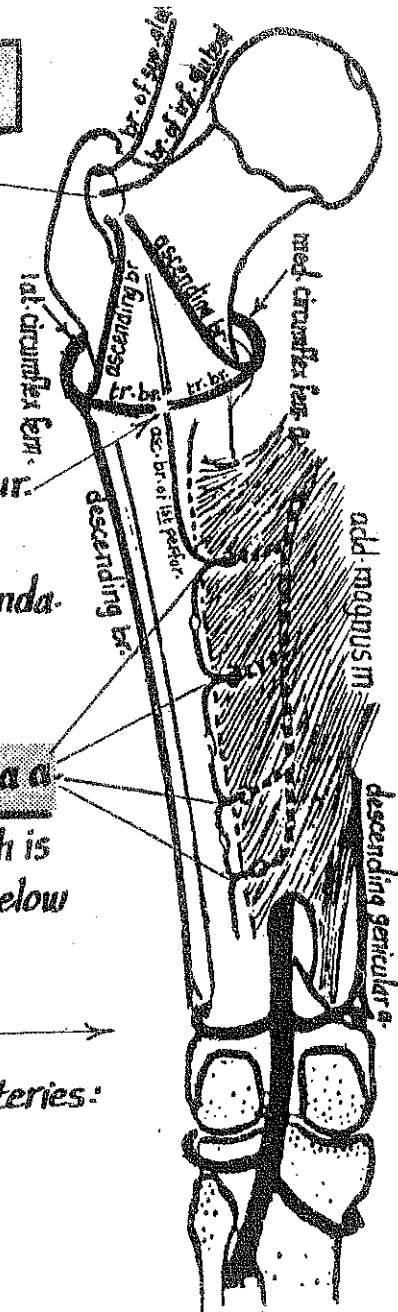
(3) Anastomosis between perforating branches of profunda a.

- it is a relatively rich anastomosis on the back of thigh which is continuous above with the cruciate anastomosis & continuous below with the anastomosis around the knee.

(4) ANASTOMOSIS AROUND THE KNEE

- it is a relatively poor anastomosis between the following arteries:

- (1) descending br. of lat. circumflex femoral a. (of profunda)
- (2) descending genicular br. of femoral a.
- (3) the 5 genicular brs. of the popliteal a.
- (4) the ant. & post. recurrent branches of ant. tibial a.



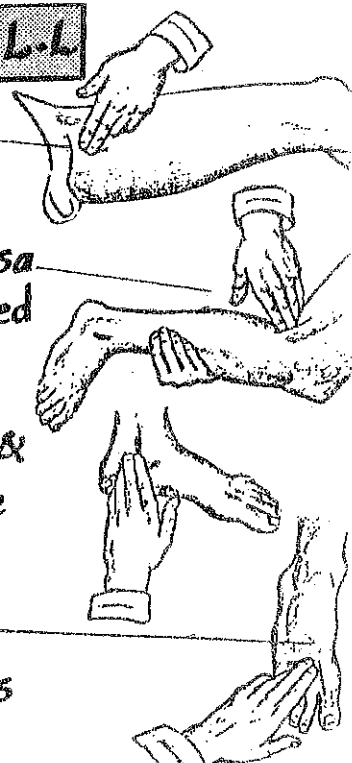
Palpation of the arterial pulsations in the L.L.

(1) Femoral a.: is palpated just below the midinguinal point by pressing the artery against the head of femur

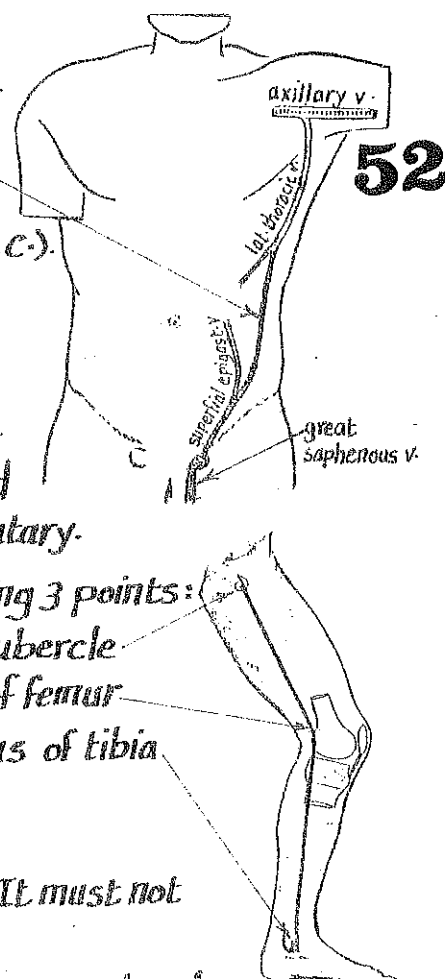
(2) Popliteal a.: is palpated by deep pressure in the popliteal fossa in the flexed knee position where the artery is pressed against the lower end of femur.

(3) Post. tibial a.: is palpated midway between the med. malleolus & the tendo achilis by pressing the artery against the back of the med. malleolus.

(4) Dorsalis pedis a.: is palpated in the 1st interosseous space, just lateral to the tendon of ext. hallucis longus



N.B: the superficial epigastric v. is connected to the lat. thoracic v. (tributary of axillary v.) via the thoraco-epigastric vein which runs on the anterolat. aspect of ant. abd. wall (allows collateral circulation in case of obstruction of Ext-iliac V. or I.V.C.).



* **Valves of great saphenous V.:** it contains 10-20 valves (especially numerous below knee). The Sapheno-femoral junction is guarded by the Trendelenberg's valve.

N.B: the valves direct the blood flow from distal to proximal & tend to lie immediately distal to the point of entry of a major tributary.

* **Surface anatomy:** represented by a line connecting the following 3 points:

- (1) point 4 cm below & lateral to the pubic tubercle
- (2) " just behind the adductor tubercle of femur
- (3) " just in front of the medial malleolus of tibia

* **Surgically important points:**

- (1) the Saphenous n. runs in front of the great saphenous v. in the leg. It must not be included in a ligature around the vein in venous cut down.
- (2) due to the direction of the valves in the vein, the stripper is better introduced in an upward direction. Also when the vein is removed for arterial grafting it has to be reversed.

II- **Small (Short) Saphenous vein**

* **Begins:** on the lat. side of dorsum of foot as a continuation of the lat. end of the dorsal venous arch

* **Course:** it curves below & behind the lat. malleolus then ascends in the middle of back of leg (accompanied by sural n. One inch below the knee, it pierces the deep fascia to enter the popliteal fossa.

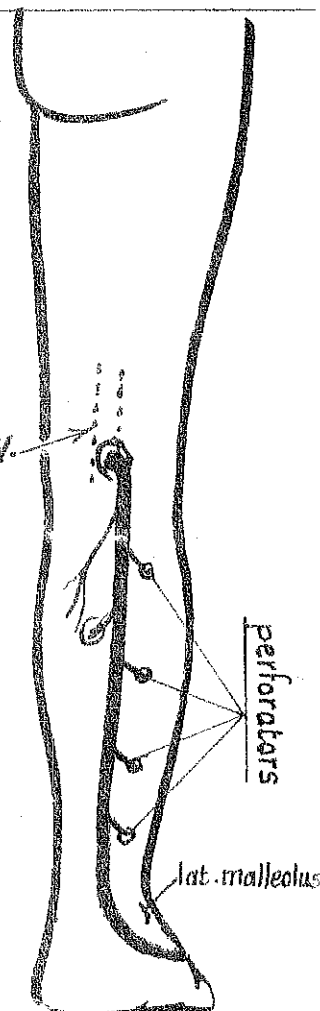
* **Termination:** variable:

- commonly it ends in the popliteal fossa by joining popliteal v. (sapheno-popliteal junction).
- less commonly it ends in the mid thigh by joining the long saphenous v. or the posteromedial v. of the thigh.
- rarely it joins the long saphenous v. at the level of the knee.

* **Tributaries & communications:**

- (1) unnamed tributaries from the foot & leg.
- (2) Communications with great saphenous V.
- (3) " " soleal venous plexus via perforators (p.53).

* **Surface anatomy:** a line connecting the centre of the popliteal fossa to a point 1 cm behind the lateral malleolus.

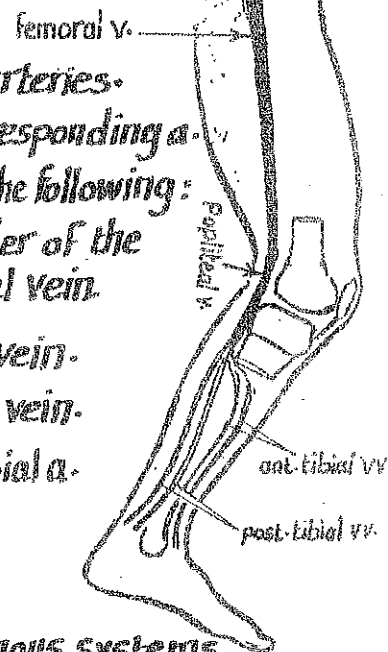


(B) The deep venous system

The deep veins of the lower limb accompany the corresponding arteries. The beginning & termination of each vein is opposite to that of the corresponding artery. The deep veins, with the exception of soleal veins, are valved & include the following:

- (1) venae comitantes of ant. tibial a. } unite together at the lower border of the popliteus m. forming the popliteal vein.
- (2) " " " post. tibial a. }
- (3) popliteal v. : ends at the adductor hiatus by becoming the femoral vein.
- (4) femoral v. : ends behind the inguinal lig. by becoming the ext. iliac vein.

N.B: the soleal venous plexus drains into venae comitantes of post. tibial a.



(C) Perforating (Communicator) Veins

These are communicator veins between the superficial & the deep venous systems. They pierce the deep fascia, transmitting blood from superficial to the deep veins. Their valves allow unidirectional flow.

Perforating veins are of 2 types :

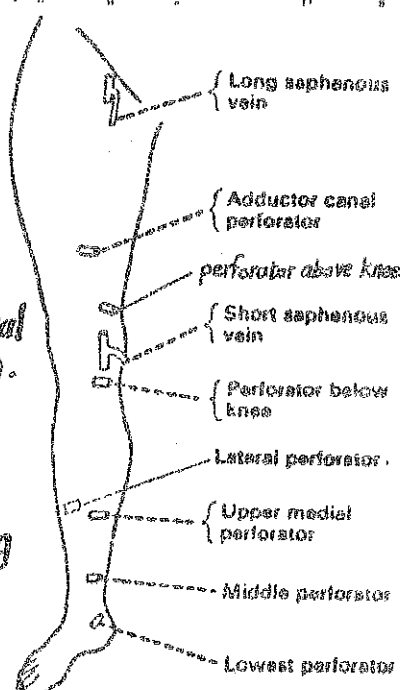
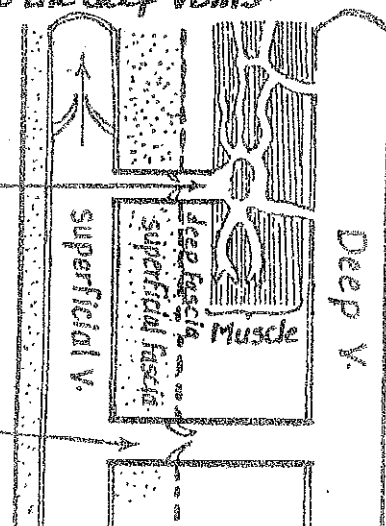
1) Indirect Communicators:

They pass from the superficial veins to muscular veins, which in turn are connected to one of the deep veins.

2) Direct Communicators:

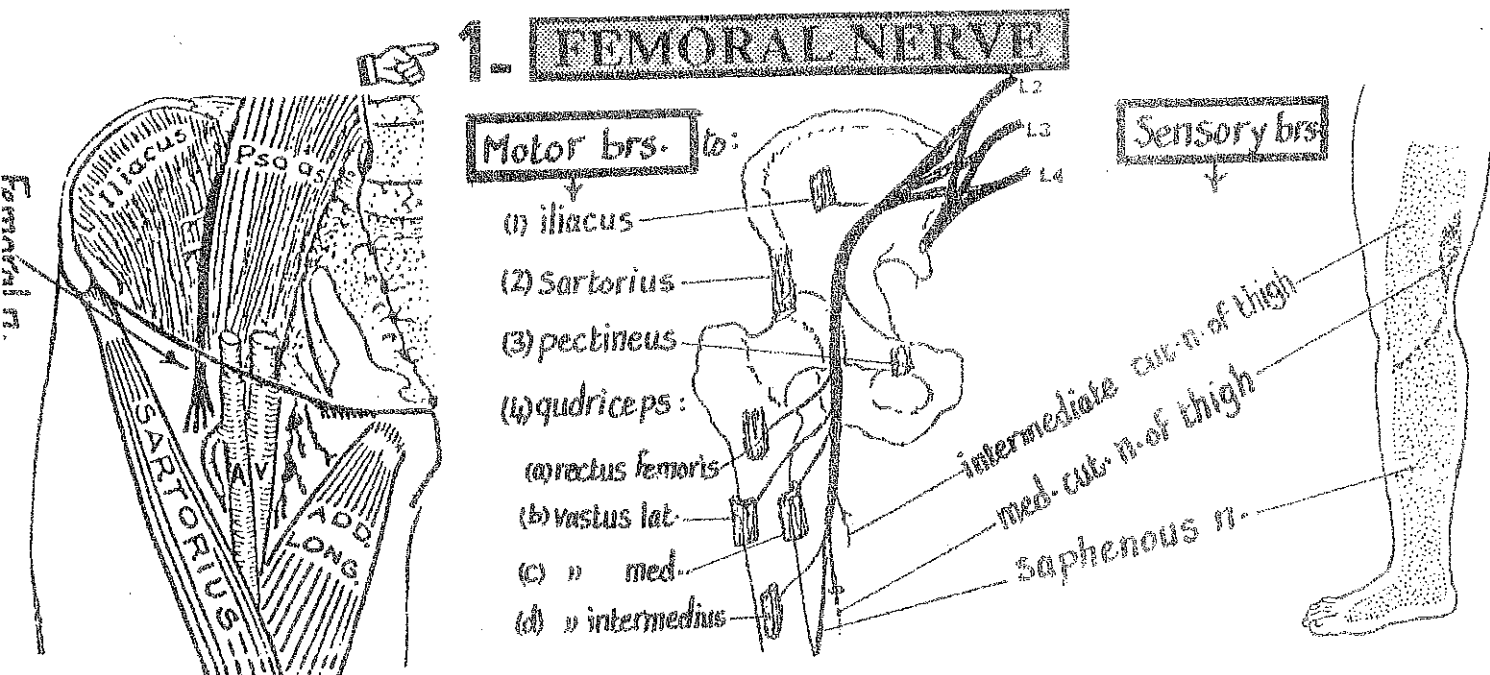
- they pass directly from superficial to deep veins.
- they include the following:

- (1) the termination of great saphenous v. (sapheno-femoral junction).
- (2) " " " short " " (sapheno-popliteal " ").
- (3) Mid thigh (adductor canal) perforator : at the middle $\frac{1}{3}$ of thigh between great saphenous v. (or one of its tributaries) & the femoral v. in the adductor canal.
- (4) above knee perforator } Connect great saphenous v. with popliteal v.
- (5) below knee perforator } (one just above & one just below knee).
- (6) Medial leg perforators (ankle perforators): are 3 lying 2, 4, 6 inches above the med. malleolus. They connect the lower part of post. arch v. with the post. tibial veins. They drain the ulcer-bearing area of the leg.
- (7) Lateral leg perforators : are 3 lying on the outer side of leg 3, 5, 7 inches above the lat. malleolus. They connect the short saphenous v. with peroneal v.



NERVES OF THE L.L

54



***Origin:** dorsal divisions of L2,3,4 roots of lumbar plexus (inside psoas major m.).

***Course:** - It emerges from the lat. border of psoas (in the abdomen) then descends between psoas & iliacus & passes behind the inguinal ligament to enter the femoral triangle lat. to the femoral artery (outside the femoral sheath).

***Termination:** it ends one inch below inguinal lig. by dividing into number of terminal brs.

***Branches:** - Motor (to 4 muscles), Sensory (3 cut. brs) & articular (to 2 joints):

Motor brs to:	Sensory branches	Articular branches
(1) iliacus m. (in abdomen) (2) sartorius (3) pectineus (4) quadriceps	(1) intermediate cut. n. of thigh (2) medial cut. n. of thigh. (3) Saphenous n. : to med. side of leg	(1) br. to hip joint (2) br. to knee joint

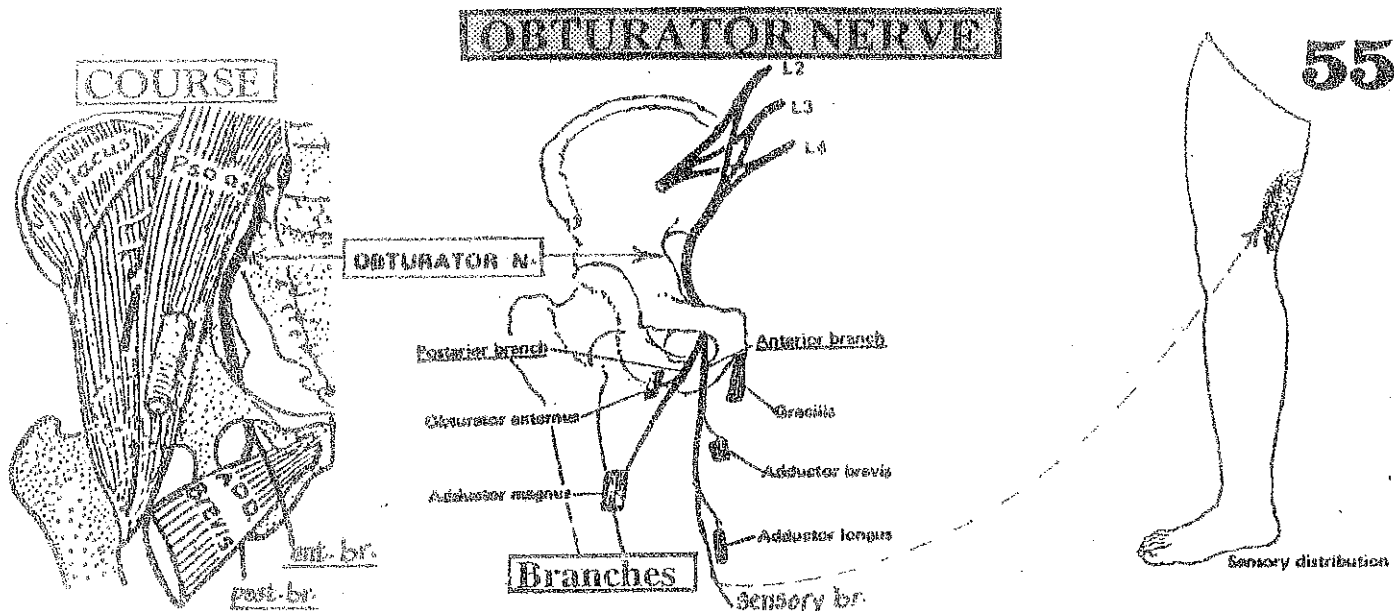
N.B: the saphenous n. is the longest n. in the body & Can be used as nerve graft.

Injury of femoral n.

- **Causes:** injury of femoral n. is uncommon. It may be caused by stab wounds or gunshot wounds in the groin.

- **Motor effects:** paralysis of quadriceps m. leads to inability to extend the knee actively but it can be extended passively by the iliotibial tract.

- **Sensory effects:** loss of sensation from the front & med. side of thigh + the med. side of leg & foot as far as the ball of hallux.



- * **Origin:** ventral divisions of L 2,3,4 roots of the lumbar plexus (inside psoas major m.).
- * **Course:** it emerges from the med. border of psoas then descends on the side wall of the pelvis to enter the thigh through the obturator canal.
- * **Termination:** it ends on entering the thigh by dividing into 2 divisions: ant. & post. (in front & behind adductor brevis muscle).

* Branches:

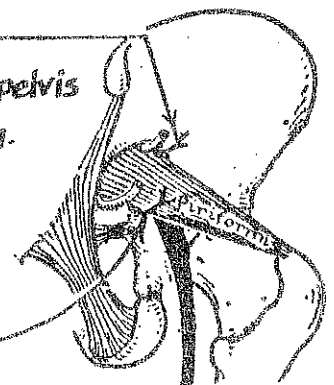
Motor: to muscles of med. side of thigh:	Sensory branch	Articular brs.
(1) gracilis (2) add. longus (3) add. brevis (4) pubic part of add. magnus (5) obturator externus m.	to the skin of med side of thigh	(1) to hip joint. (2) to knee "
} from ant. division. } from post. division.		

* Injury of obturator n. (rare):

- Causes: penetrating wound, pressure on the nerve by gravid uterus or obturator hernia.
- Motor effects: inability of adduction & external rotation of thigh (Crossing of legs is difficult).
- Sensory: pain on the med. side of thigh (sensory loss is usually insignificant).

SUPERIOR GLUTEAL NERVE

- * **Origin & Course:** arises from the sacral plexus (L 4,5 & S1). & leaves the pelvis through greater sciatic foramen above piriformis to reach the gluteal region.
- * **Branches:** it supplies gluteus medius & minimus + tensor fascia latae m.
- * **Its injury:** lead to paralysis of the above-mentioned muscles → weak abduction of hip → Waddling gait.



INFERIOR GLUTEAL NERVE

- * **Origin & Course:** from the sacral plexus (L5, S1,2). It leaves the pelvis through greater sciatic foramen below piriformis to reach the gluteal region.
- * **Branches:** it supplies gluteus maximus m.
- * **Its injury:** → paralysis of gluteus maximus →
 - difficult rising from a seated position.
 - climbing stairs.
 - running or jumping.

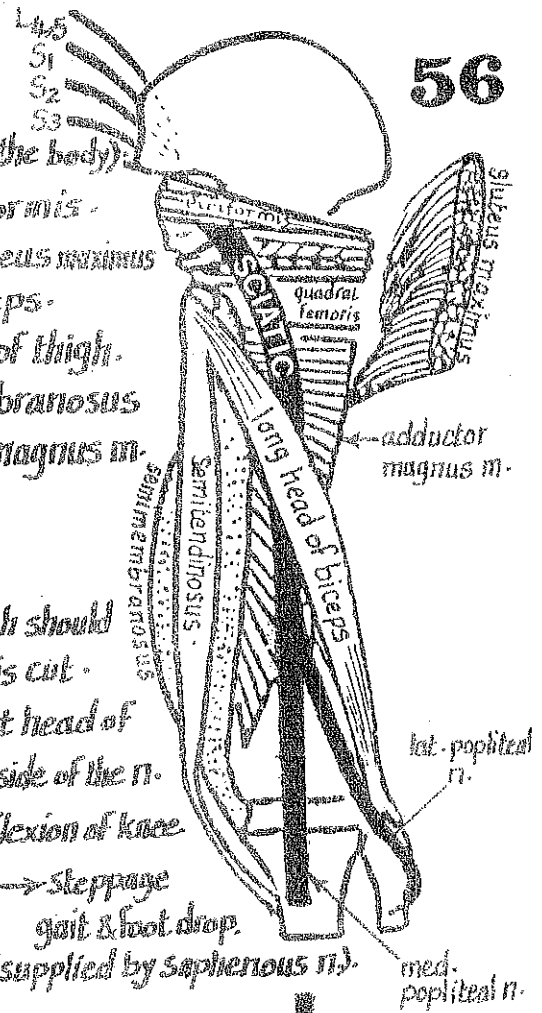


SCIATIC NERVE

- * **Origin** : it is the largest br. of the sacral plexus (& thickest n. in the body).
- * **Course** : - it leaves the pelvis through greater sciatic f. below piriformis -
- it descends, first in the gluteal region under cover of gluteus maximus then on the back of thigh under cover of long head of biceps.
- * **End** : by dividing into med. & lat. popliteal nerves at the middle of thigh.
- * **Branches** : (A) Motor : to hamstring muscles (biceps, semimembranosus & semitendinosus) + ischial part of add. magnus m.
(B) Articular br. : to the hip joint.

Surgically important points :

- (1) sciatic n. is accompanied by a small artery (br. of inf. gluteal a.) which should be ligated in 'above knee amputation' to avoid bleeding when sciatic n. is cut.
- (2) all brs. of sciatic n. emerge from its med. side except the br. to short head of biceps (from its lat. side). So, surgical incisions should be done on lat. side of the n.
- (3) **Injury of sciatic n. leads to** :
 - (A) paralysis of all muscles supplied
 - ↳ Hamstrings → loss of flexion of knee
 - ↳ all muscles of leg & foot → steppage gait & foot drop.
 - (B) loss of sensation below knee except on med. side of leg & foot (supplied by saphenous n.).

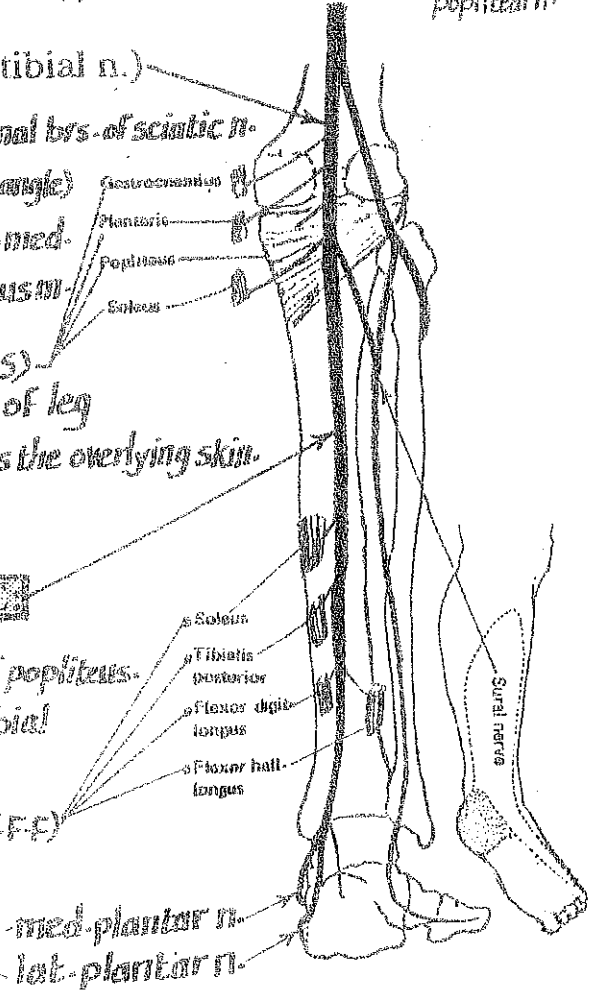


MEDIAL POPLITEAL NERVE: (tibial n.)

- * **Origin** : at the middle of back of thigh as the larger of the 2 terminal brs. of sciatic n.
- * **Course** : it traverses the popliteal fossa (from upper angle to lower angle) crossing behind (superficial to) popliteal vessels from lat. to med.
- * **it ends** : by becoming post. tibial n. at the lower border of popliteus m.
- * **Branches** : A- Motor : to 4 muscles on the back of leg (G.P.P.S.)
B- Cutaneous : sural n. which runs on the back of leg & lat. side of foot with short saphenous v. & supplies the overlying skin.
C- Articular : 3 genicular brs. to the knee joint.

POSTERIOR TIBIAL NERVE:

- * **Begins** : as a continuation of med. popliteal n. at lower border of popliteus.
- * **Course** : it descends in the back of leg accompanying post. tibial (between the superficial & deep calf muscles)
- * **Branches** : (A) Motor : to 4 muscles on the back of leg : (S-T-F-F)
(B) cutaneous br. : to the skin of the heel
- * **It ends** : deep to the flexor retinaculum by dividing into



Injury of med. popliteal or post. tibial n. :

- (1) paralysis of muscles of back of leg + muscles of foot → inability to plantarflex or invert foot.
- (2) loss of sensation over the sole (except the med. border which is supplied by saphenous n.).
- (3) Talipes Equinovarus deformity (clawing of foot & inversion of foot).

LATERAL POPLITEAL NERVE (common peroneal n.)

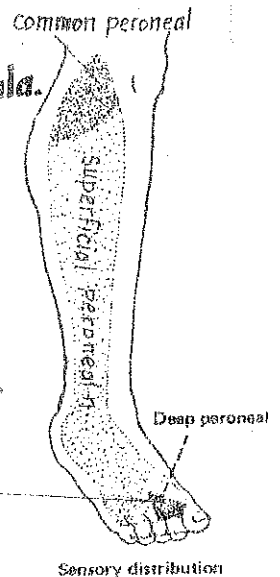
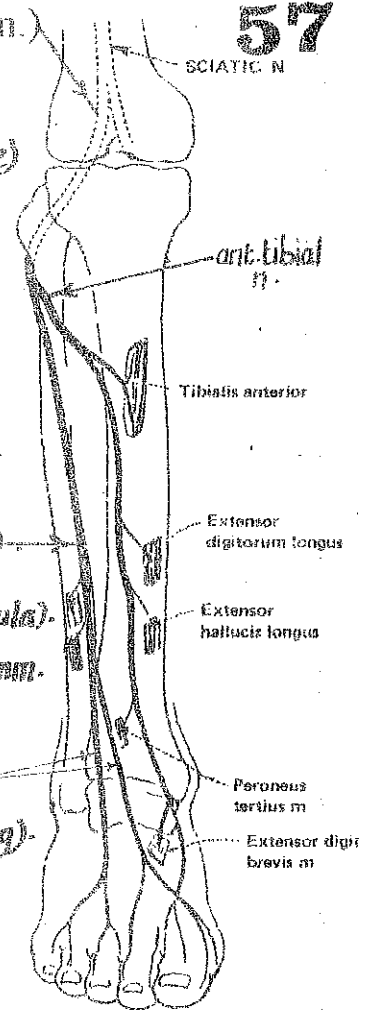
- * Begins: as the smaller of the 2 terminal brs. of sciatic n. at the back of thigh.
- * Course: it descends in the popliteal fossa (from its upper angle to its lat. angle) along the med. side of biceps m. then pierces peroneus longus m.)
- * Ends: inside peroneus longus m. on the lat. aspect of neck of fibula by dividing into 2 terminal brs.: musculocutaneous & ant-tibial.
- * Branches: (A) No muscular brs.
(B) 2 cutaneous brs.: $\begin{cases} \text{sural communicating: joins sural n.} \\ \text{lat. cut. n. of calf} \rightarrow \text{upper lat. aspect of leg.} \end{cases}$
(C) 3 genicular brs. to knee.

MUSCULO-CUTANEOUS NERVE: (superficial peroneal n.)

- * Begins: as one of the 2 terminal brs. of lat. popliteal n. (on lat. aspect of neck of fibula).
- * Course: in the upper $\frac{1}{3}$ of leg, it descends between peroneus longus & brevis mm. then becomes superficial in the lower $\frac{2}{3}$.
- * Ends: in the lower part of leg by dividing into med. & lat. terminal cut. brs.
- * Branches: (A) motor: to peroneus longus & brevis (mm. of lat. compartment of leg).
(B) cutaneous: to lower $\frac{2}{3}$ of antero lat. aspect of leg + dorsum of foot except the cleft between the 1st & 2nd toes

ANTERIOR TIBIAL NERVE: (deep peroneal n.):

- * Begins: as one of the 2 terminal brs. of lat. popliteal n. on lat. aspect of neck of fibula.
- * Course: it enters the ant. compartment of leg & accompanies the ant-tibial a. lying first on interosseous memb. then on ant. surface of lower end of tibia.
- * Ends: just below inf. ext. retinaculum by dividing into med. & lat. terminal brs.
- * Branches: (A) Motor: to the 5 muscles of ant. compartment of leg & dorsum of foot: (1) tibialis ant. (2) Ext. hallucis longus (3) Ext. digit. longus (4) peroneus tertius (5) ext. digit. brevis.
(B) Sensory: to the skin of the 1st cleft (between the 1st & 2nd toes)
(C) articular: to the ankle joint & joints of the foot.



Injury of the lat. popliteal nerve

- * Causes: wounds in popliteal fossa or fracture of neck of fibula.
- * Motor effects: (1) paralysis of muscles of ant. compartment of leg $\rightarrow$ Foot drop.
(2) " " " " " lat. " " " $\rightarrow$ inversion.
- * Deformity: talipes equino-varus (Foot drop with inversion)
- * Sensory effects: loss of sensation from the anterolateral aspect of leg & dorsum of foot.



JOINTS OF THE L.L

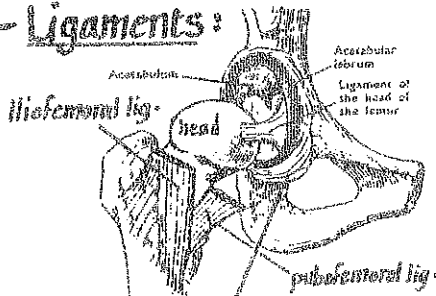
58

JOINT

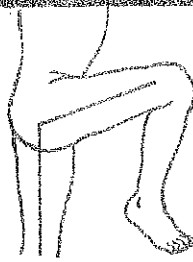
Movements:

1- HIP JOINT:

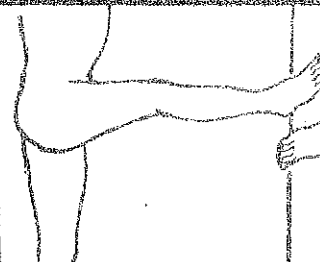
- Type : synovial ball & socket
- Bones : head of femur with acetabulum of hip bone
- Ligaments :



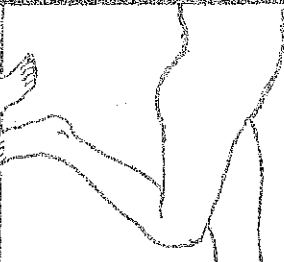
- (1) Capsular lig. (capsule)
- (2) Iliofemoral lig.
- (3) pubofemoral lig.
- (4) ischiofemoral lig
- (5) round lig. of the head



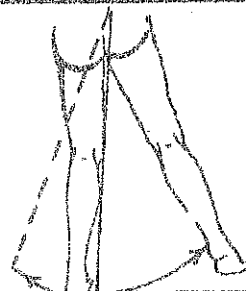
Flexion: 120°
with flexed knee



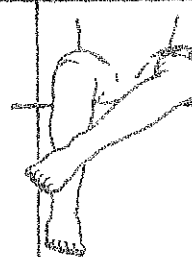
Flexion: 90°
with extended knee



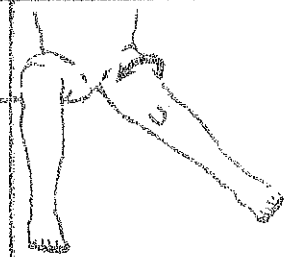
• Extension : 0°
• Hyper-extension : 15°



Adduction: 30°



Abduction: 45°



Ext-rotation 45°

Int-rotation 40°

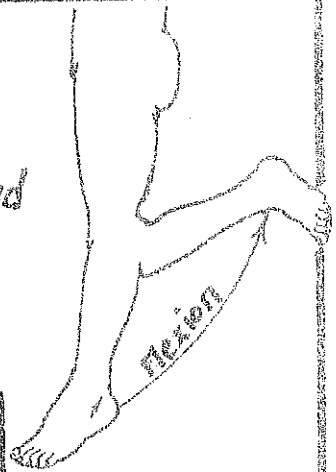
2. Knee Joint:

- Type : synovial, condylar
- Bones : lower end of femur, post-surface of patella & upper end of tibia.
- Ligaments :

- (1) patellar lig. (in front)
- (2) post-oblique lig. (behind)
- (3) tibial collateral lig. (medially)
- (4) fibular lig. (laterally)

- (1) Flexion : 130°
- (2) Extension : 0°
- (3) Hyperextension 15°.
- (4) locking : lat. rotation of tibia at the end of extension.
- (5) unlocking : med. rotation of tibia at the beginning of flexion.

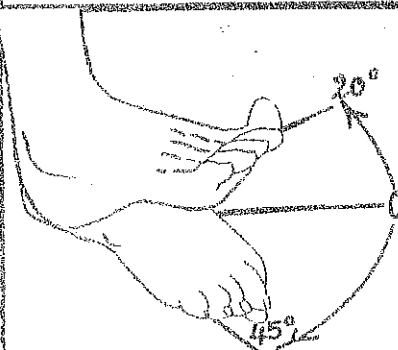
N.B: the intracapsular structures of knee joint are:
(a) the 2 menisci (b) 2 cruciate ligs (c) popliteus tendon



3. Ankle Joint:

- Type : synovial hinge
- Bones : talus & lower ends of both tibia & fibula
- Ligaments :

- (1) med. lig. (deltoid lig.)
- (2) lat. lig.

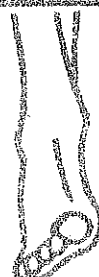


dorsiflexion 20°

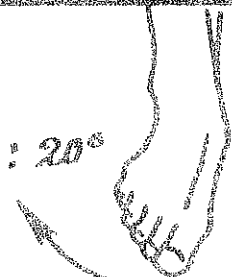
plantar flexion 45°

4. Talo-calcaneo-navicular joint:

- synovial ball & socket between talus, calcaneus & navicular bones.



Inversion: 30° - Eversion: 20°



IMPORTANT REGIONS OF L.L

FEMORAL TRIANGLE

It is a shallow triangular depression in the upper $\frac{1}{3}$ of front of thigh.

Boundaries:

- Laterally : med. border of sartorius m.
 - Medially : med. border of adductor longus m.
 - Base (above) : the inguinal ligament.
 - Apex (below) : meeting of sartorius & adductor longus.
- It is continuous below with the adductor canal.

Floor : formed of the following 4 muscles (arranged from med. to lat.):

(1) adductor longus (2) pectineus (3) psoas major (4) iliacus.

Roof : formed of skin, superficial fascia & deep fascia.

the superficial fascia contains:

- A- Superficial inguinal arteries
 - Superficial epigastric
 - Superficial ext. pudendal
 - superficial circumf. iliac
- B- upper part of great saphenous v.
- C- Superficial inguinal L-Ns
 - horizontal group : below inguinal lig.
 - vertical group : along great saphenous v.

the deep fascia : contains the saphenous opening

which lies 4 cm below & lat. to the pubic tubercle. It has sharp border except

It is covered by cribriform fascia & transmits :

- (a) great saphenous v.
- (b) superficial brs. of femoral a.
- (c) lymphatic vessels.

* Contents of the Triangle:

- (1) Femoral artery and its branches : profunda femoris & deep external pudendal a.
- (2) Femoral vein and its tributaries (the vein is med. to the artery at the base).
- (3) Femoral sheath : surrounding the upper 4 cm of femoral vessels.
- (4) femoral n. (outside femoral sheath), femoral br. of genitofemoral n. & lat. cut. n. of thigh.
- (5) Deep inguinal L-Ns (alongside femoral vessels).

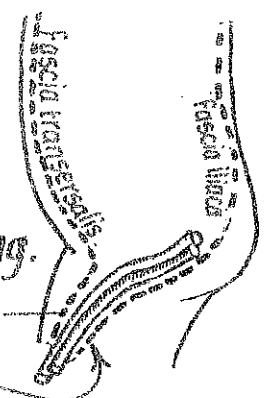
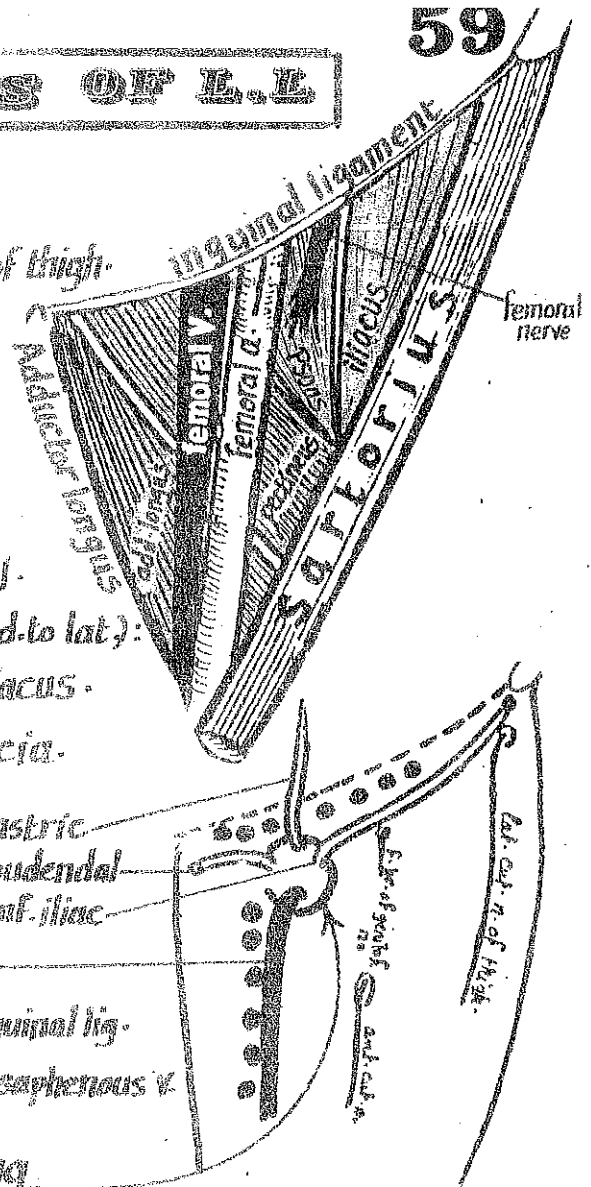
FEMORAL SHEATH :

* It is a fascial sheath surrounding the upper 4 cm. of femoral vessels.

* **Site** : in the femoral Δ , below middle part of ing. lig. & behind saph. opening.

* **Formation** :

- ant. wall : downward prolongation of fascia transversalis
- post. wall : fascia iliaca



* Compartments : 2 antero-posterior septa divide the sheath into:

- (1) Lat. Compartment : Containing the femoral artery
- (2) middle : Containing femoral V.
- (3) Medial : the femoral canal

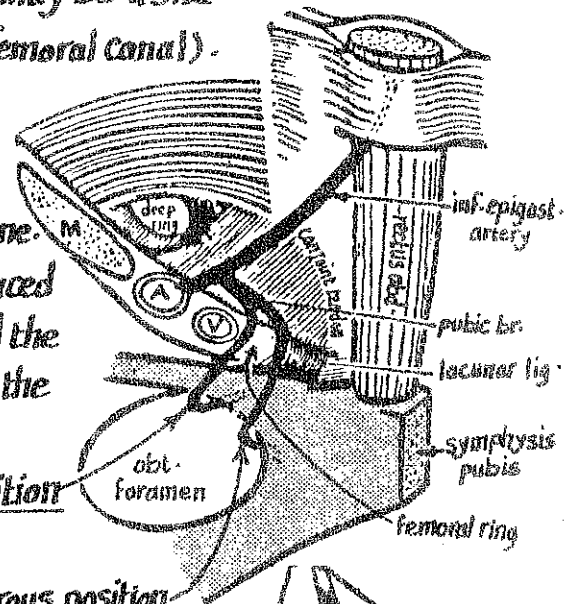
* FEMORAL CANAL

- Site & Size : it is the med. compartment of femoral sheath ($1\frac{1}{2}''$ long).
- Shape : conical in shape having wide opening above & narrow opening below.
- upper opening : the femoral ring : opens into abd. cavity & bounded by :
 - (a) inguinal lig. (anteriorly) (b) pectineal lig. (posteriorly).
 - (c) femoral V. (laterally) (d) the sharp edge of lacunar lig. (medially).
- lower opening : opens into the femoral Δ .
- Contents of the Canal : (1) loose C.T. (2) lymphatic vessels (3) one L-N (L-N of Cloquet).
- Functions of the Canal : (1) passage of lymphatics from the lower limb to the abdomen. (2) acts as a dead space to allow distension of the femoral V.

- Surgical importance :

- (1) femoral canal is a weak point in the abdom wall which may be a site of femoral hernia (more common in females due to wider femoral canal).
- (2) Abnormal obturator a. :

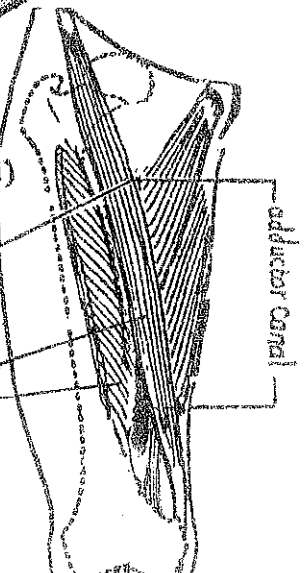
- ~ normally, the pubic br. of inf-epigastric a. anastomoses with the pubic br. of obturator a. behind body of pubic bone.
- in 30% of cases, the obturator a. itself is absent & replaced by large pubic br. of the inf-epigastric a. This is called the abnormal obturator a. which passes down in relation to the femoral ring to reach the obturator foramen as follows:
 - (a) it may stick to the side of the femoral vein (safe position during operation for femoral hernia).
 - (b) It may descend behind the edge of lacunar lig. (dangerous position as it may be cut during the operation).



ADDUCTOR CANAL

(Subsartorial or Hunter's canal)

- * Site : middle $\frac{1}{3}$ of med. side of thigh : begins at the apex of femoral triangle ends at the adductor hiatus
- * Boundaries :
 - Roof : fibrous memb. on which lies the sartorius muscle
 - Lat. wall : vastus medialis muscle
 - Floor : adductor longus & magnus muscles.



* Contents of the adductor Canal :

- (1) femoral vessels : the V is post. to the a. in the upper part & posterolat. in the lower part.
- (2) descending genicular branch of femoral a.
- (3) Saphenous n. (crosses the vessels from lat. to med.).
- (4) n. to vastus medialis (lies lat. to the vessels.).

POPLITEAL FOSSA

* It is a diamond shaped space on the back of knee joint.

* Boundaries :

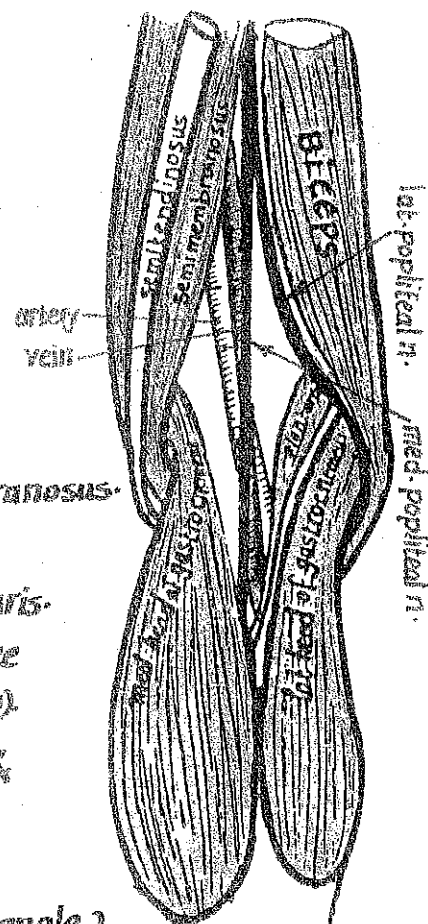
- its upper lat. border is formed by biceps m.
- " " med. " " " " " semitendinosus & semimembranosus.
- " " lower med. " " " " " med. head of gastrocnemius m.
- " " lat. " " " " " lat. head of gastrocnemius + plantaris.

* Floor : popliteal surface of femur (above), back of capsule of knee joint (in the middle) & fascia covering popliteus m. (below).

* Roof : - skin & superficial fascia containing short saphenous v. & post. cut. n. of thigh. & deep fascia.

* Contents :

- (1) Med. popliteal n. : bisects the fossa from the upper to the lower angle.
- (2) Lat. popliteal n. : descends along the med. border of biceps muscle } most superficial
- (3) popliteal v. & its tributaries : intermediate in position.
- (4) popliteal a. & its branches : the deepest structure in the fossa.
- (5) popliteal LNs, pad of fat & semimembranosus bursa



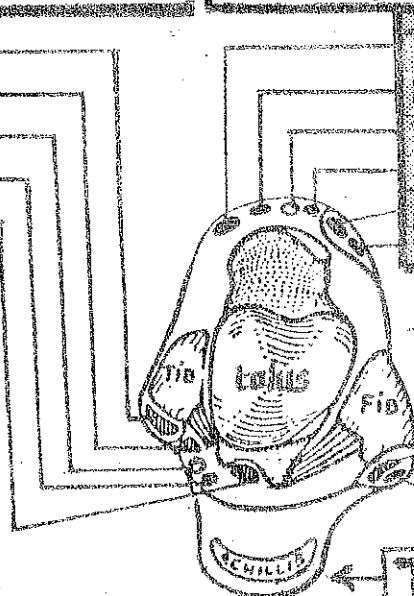
Structures around ankle

Posteromed.: structures deep to flex. retinac.

Tibialis post	Tom
ext. Digitorum longus	Does
Post. tibial Vessels	Very
" " Nerve	Nice
flexor Hallucis longus	Hats

Anteriorly: structures deep to ext. retinac.

Tom	Tibialis ant.
Has	ext. Hallucis longus
Very	ant. tibial Vessels
Nice	ant. " Nerve
Do	ext. Digitorum longus
Pig	peroneus tertius



Post-lat.: structures deep to peroneal retinac.

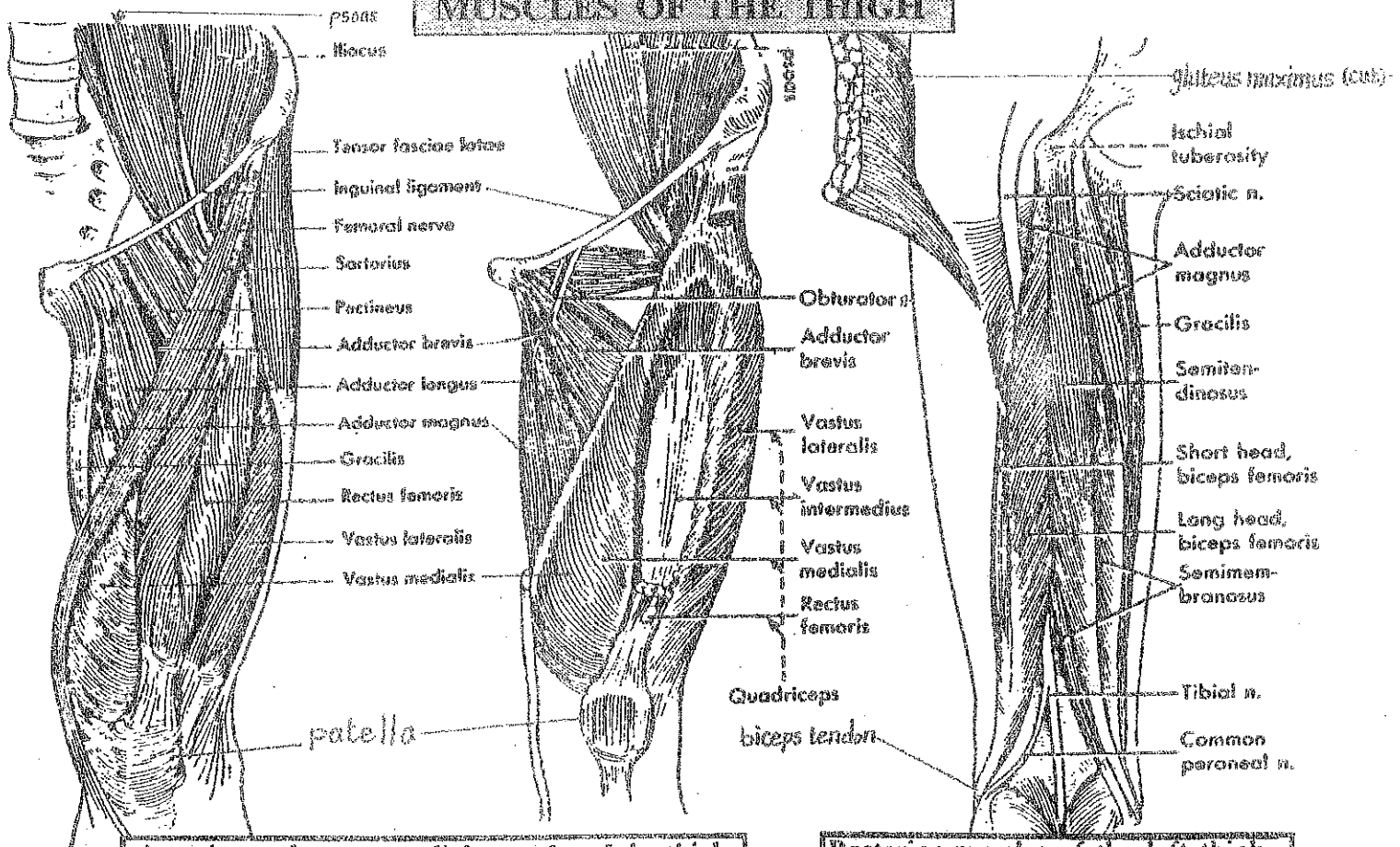
- (1) peroneus brevis tendon.
- (2) " longus "

T.S at the ankle

SPOTTING OF LOWER LIMB

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MUSCLES OF THE THIGH

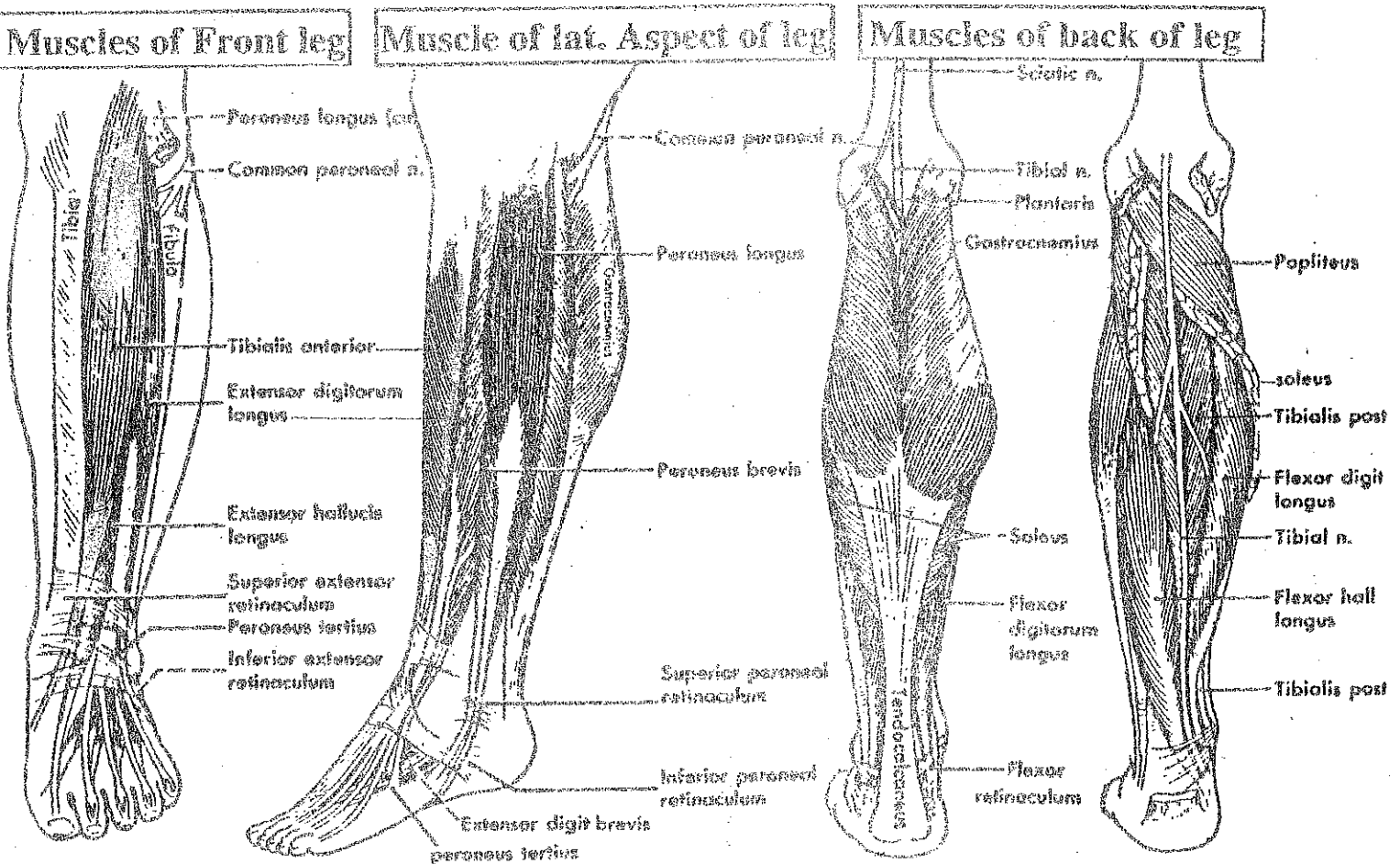


Anterior and anteromedial muscles of the thigh.

Posterior muscles of the left thigh.

Muscle	Identifying Feature(s)
Sartorius	(1) the longest m. in the thigh, attached above to A-S-I-S & below to upper end of tibia (2) it is strap-like (has 2 parallel borders) & fleshy all through (no tendon).
rectus femoris	a fusiform m in the middle of thigh (lat. to sartorius) & ending at the patella below.
Vastus medialis	lies med. to rectus femoris & its lowermost part is attached to the patella.
Vastus lateralis	lies lat. " " " " " " " " " " " "
" intermedius	lie deep to rectus femoris (between vastus medialis & lateralis).
gracilis	the most med. m. in the thigh & has tendon below inserted behind sartorius (S-G-S)
add. longus	a Δ m. in the upper med. part of thigh (lat. to gracilis) & reaches the middle of thigh
pectineus	in the same plane of add. longus & lat. to it. It is crossed by femoral vein.
add. brevis	flat m. in the upper 1/4 of thigh behind add. longus & between the 2 hrs. of obturator n.
add. magnus	the thickest & most post. m. of med. side of thigh (behind adductor longus & brevis).
ilio-psoas	in the upper lat. part of front of thigh, behind femoral artery & nerve.
gluteus max.	the thickest & most superficial m. in the gluteal region
biceps femoris	on the lat. side of back of thigh & has 2 heads: long & short.
Semitendinosus	the superficial m. on the med. side of back of thigh. Its lower 1/2 is tendon.
" membranousus	lies deep to semitendinosus & its upper 1/2 in a membrane.

MUSCLES OF THE LEG



1. Muscles of the front of the leg:

identified by their tendons which cross in front of ankle in the following order :

- (1) Tom : Tibialis anterior
 - (2) Has : Ext. Hallucis longus
 - (3) Dog : Ext. Digitorum "
 - (4) Pig : Peroneus tertius
- } arranged from med. malleolus to lat. malleolus

2. Muscles of the lat. aspect of the leg:

identified by their tendons which pass behind the lat. malleolus as follows :

- (1) peroneus longus tendon : superficial
- (2) " brevis tendon : deep

3. Muscles of back of the leg:

a. Superficial group: 3 muscles which unite in the lower $\frac{1}{3}$ of leg forming tendocalcaneus

- & are identified as follows :
- (1) gastrocnemius : superficial & has 2 heads (med. & lat.)
 - (2) soleus : deep to gastrocnemius & is bulky.
 - (3) plantaris : small m. with very long tendon.

b. Deep group: identified by their tendons which pass behind the med. malleolus

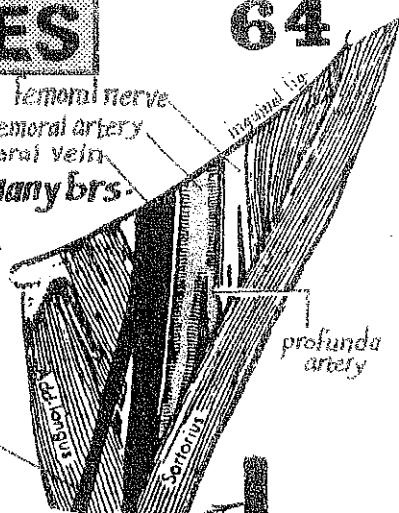
- (1) Tom : Tibialis post.
 - (2) Does : flexor Digitorum longus
 - (3) Hats : " Hallucis "
- } arranged from med. to lat.

VESSELS AND NERVES

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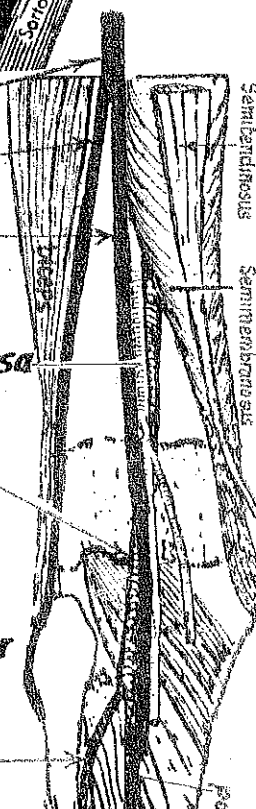
I- In the femoral triangle :

- (1) femoral n. : lat. in position & ends 1" below inguinal lig. by giving many brs.
- (2) femoral a. : intermediate in position between the nerve & the vein.
- its largest br. is the profunda (deep femoral) a.
- (3) femoral v. : the most med. structure in the femoral Δ
- its longest tributary is the great saphenous v.



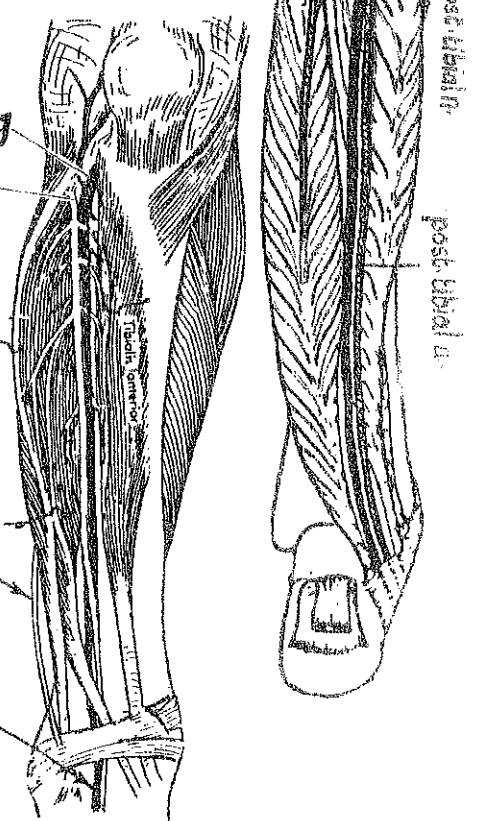
II- In the back of thigh & popliteal fossa :

- (1) Sciatic n. : a very thick nerve in the upper part of back of thigh
- (2) lat. popliteal n. : descends along med. border of biceps muscle
- (3) med. popliteal n. : the most superficial structure in the middle line of the popliteal fossa.
- (4) popliteal vein : the intermediate structure in the middle line of popliteal fossa
- (5) popliteal artery the deepest structure in the middle line of the fossa.



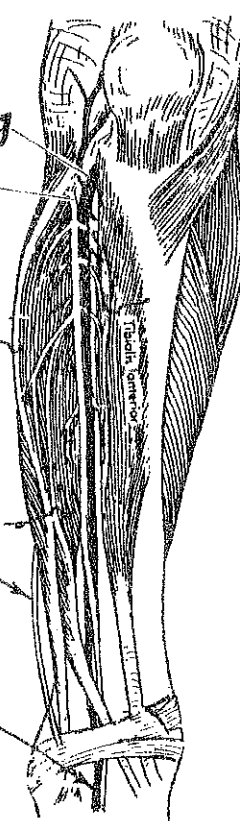
III In the back of leg (between superficial & deep calf muscles) :

- (1) post. tibial n. : is the downward continuation of the med. popliteal n.
- (2) post. tibial a. : one of the 2 terminal brs. of popliteal a. at the lower border of popliteus & continues down to the back of the med. malleolus.
- (3) peroneal a. : is the largest br. of post. tibial a. & descends along fibula



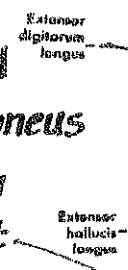
IV- In the anterior compartment of leg :

- (1) ant. tibial a. : is the only artery in the ant. compartment of leg
- (2) ant. tibial n. : » » » nerve in the ant. compartment of leg



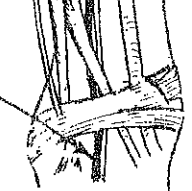
V- Lat. Compartment of leg :

- the musculo-cutaneous n. is the only n. in the lateral compartment of leg. It descends first between peroneus longus & brevis muscles then becomes superficial in the lower $\frac{1}{2}$ of the leg & descends to the dorsum of foot.



VI- Dorsum of foot :

- the dorsalis pedis a. is the only a. on the dorsum of foot.

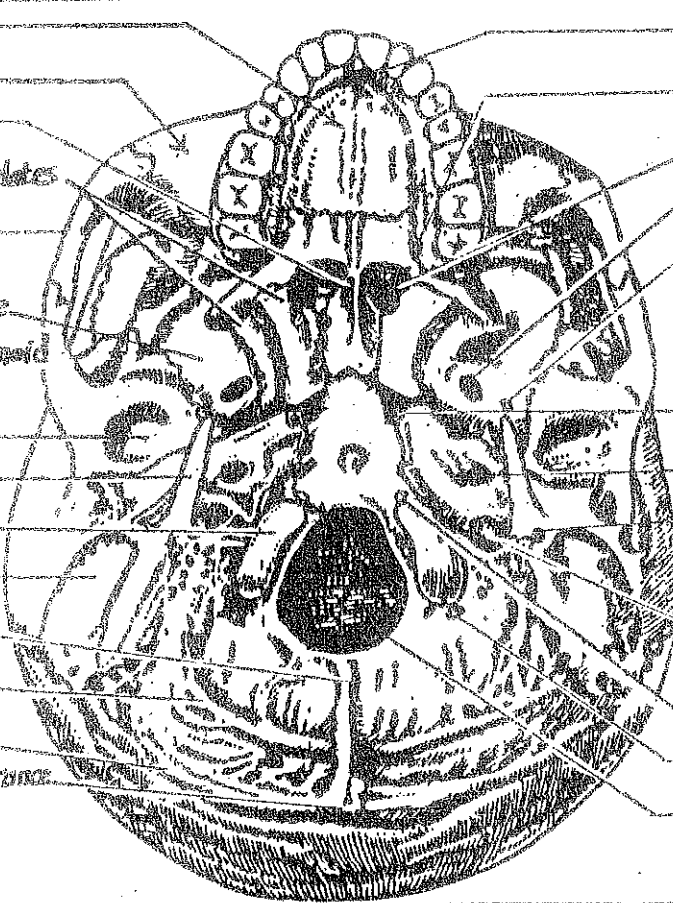


THE SKULL

A-EXTERIOR OF BASE OF SKULL

IMPORTANT FEATURES

- * hard palate
- * Maxilla
- * Vomer
- * Med. & lat. pterygoid plates
- * Zygomatic arch
- * Infra temporal surface of greater wing of sphenoid
- * Articular fossa
- * Styloid process
- * occipital Condyle
- * mastoid process
- * external occipital crest
- * inf. nuchal line
- * sup. nuchal line
- * external occipital protuberance



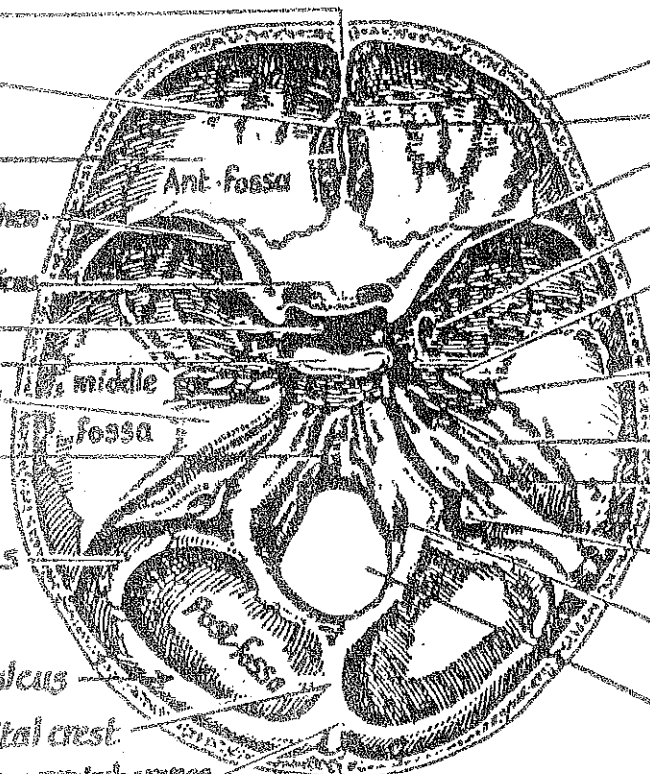
- incisive fossa
- Greater palatine f.
- Post-nasal orifice
- foramen ovale
- foramen spinosum
- foramen lacerum
- carotid canal
- Stylomastoid f.
- jugular foramen
- ant. Condylar f.
- post. " "
- foramen magnum.

IMPORTANT FORAMINA

B-INTERIOR OF CRANIUM

FEATURES

- * frontal crest
- * crista galli
- * orbital plate
- * lesser wing of sphen.
- * sulcus chiasmaticus
- * pituitary fossa
- * dorsum sellae
- * petrous temporal
- * clivus
- * Sigmoid sulcus
- * transverse sulcus
- * internal occipital crest
- * " " " protuberance



FORAMINA

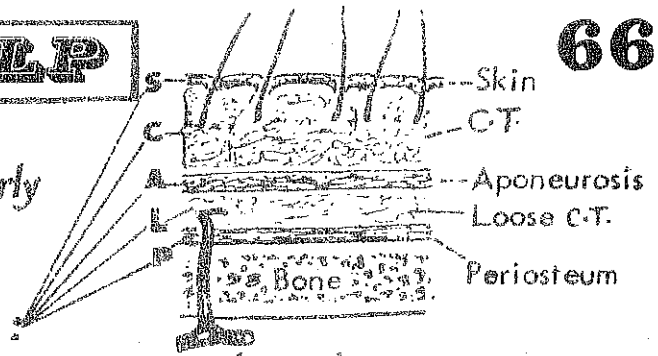
Foramen	Structures passing
Caecum	emissary v.
cribriform plate of ethmoid	olfactory n. fibres
sup. orbital fissure	3rd, 4th, ophthalm. br. of 5th & 6th cranial nerves
Rotundum	Maxillary n.
ovale	mandibular n. accessory meningeal a. emissary v.
spinosum	- middle meningeal a. - nervus spinosus
lacerum	I-C-A & emissary veins.
internal audit. meatus	- 7th & 8th cranial nn. - internal auditory vess.
jugular	- 9th, 10th, 11th cranial nn. - internal jugular v.
ant. condylar	12th cranial n.
Magnum	- lower end of medulla. - spinal roots of accessory n. - spinal & vertebral aa.

THE SCALP

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- * It is the soft tissue covering the skull cap.
- * Extent : it extends from the sup-nuchal lines posteriorly to the eye brows anteriorly.

* Structure : it is formed of the following 5 layers :

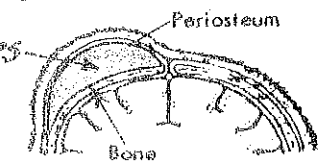
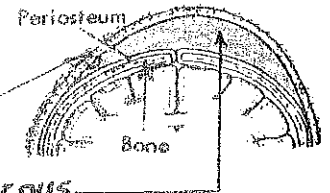


- (1) Skin : rich in hair follicles & sebaceous glands (very common site of epidermoid cysts).
- (2) Connective tissue : dense fatty C.T. attaching the skin to the underlying aponeurosis.
- (3) Aponeurosis : a flat membrane connecting the frontal & the occipital bellies of occipitofrontalis m.
- (4) Loose areolar C.T. : allowing free mobility of the first 3 layers on the underlying periosteum.
- (5) Periosteum (pericranium) : loosely attached to the bones but firmly attached to the sutural lines.

Sensory n. supply of scalp	blood supply of scalp
Supplied by trigeminal (5th) nerve : (1) Supratrochlear n. (br. of ophthalmic) (2) supra-orbital n. (br. " ") (3) Zygomatico temporal n. (br. of maxillary) (4) auriculo-temporal n. (br. of mandibular)	(1) supratrochlear } brs. of ophthalmic a. of the I.C.A (2) supra-orbital } a. of the I.C.A (3) superficial temporal : br. of ext-carotid a.
Supplied by Cervical nerves : (5) great auricular (C4) (6) lesser occipital (C2, 3) (7) greater occipital (C2) (8) Third occipital (C3)	(4) post-auricular } brs. of E-CA (5) occipital a

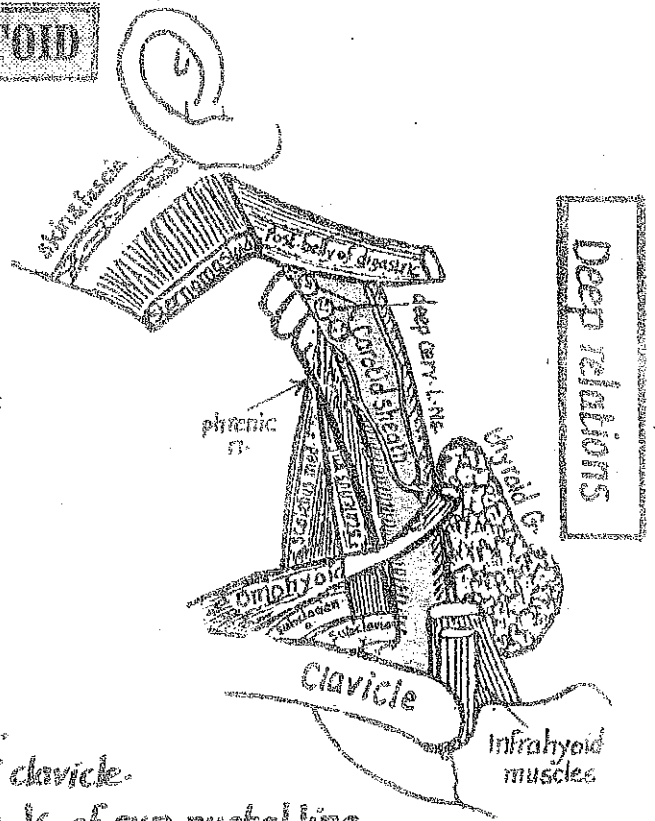
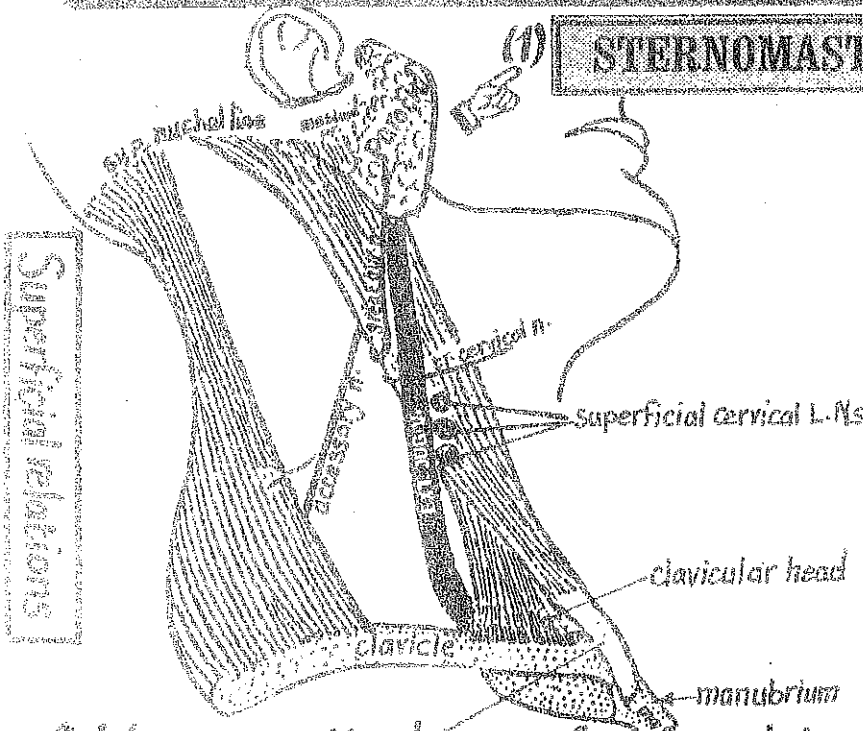
* SURGICAL IMPORTANCE

- (1) the 1st 3 layers of the scalp (skin, C.T. & aponeurosis) are intimately united and should be considered as one layer. Subaponeurotic collection of blood fluid or pus produces diffuse swelling which may extend anteriorly to the eye lids or posteriorly to sup-nuchal line.
- (2) Subperiosteal collection of blood (as in fissure or fracture of a skull bone) produces a localized swelling overlying one bone as periosteum is firmly attached to the sutural lines.
- (3) The scalp has very rich blood supply by freely anastomosing vessels, this explains the following facts:
 - (a) wounds of the scalp bleed profusely. Bleeding can be stopped by compressing the scalp upon the underlying skull bone.
 - (b) wounds heal well, minimal or no débridement is required & wound infection is uncommon.



IMPORTANT MUSCLES OF H&N

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- * **Origin** : (1) sternal head : ant. surface of manubrium.
(2) Clavicular » : med. 1/3 of upper surface of clavicle.
- * **Insertion** : (1) lat. surface of mastoid process (2) lat. 1/3 of sup. nuchal line.
- * **N. supply** : (1) spinal accessory n. (motor) (2) brs. from C2, C3 (proprioceptive).
- * **Action** : (1) when one muscle acts it bends the head to the same side & turns the face to opposite side.

Superficial relations	Deep relations
(1) skin & superficial fascia containing: platysma, ext. jugular v., superficial cervical L.N.s, great auricular & transverse cervical nerves. (2) deep fascia (3) parotid gland (in the upper part).	(1) infrahyoid muscles (in the lower part). (2) scalenus ant. & phrenic n. in front of it. (3) lat. lobe of thyroid gland. (4) Carotid sheath & its contents & deep cervical L.N.s.

(2) SCALENUS ANTERIOR

* **O.** : ant. tubercles of tr. processes of C3, 4, 5 & 6.

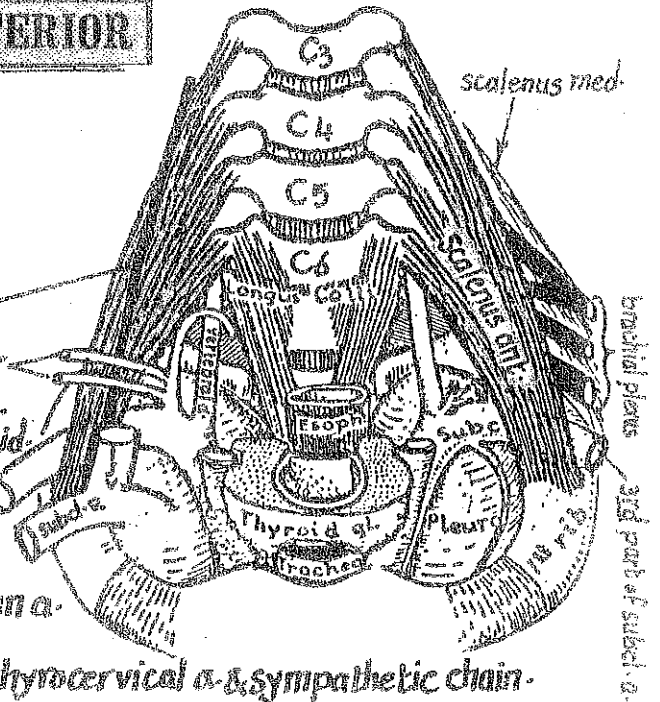
* **I.** : scalene tubercle of first rib.

* **N.s** : ant. 10th rami of C4, 5, 6

* **Action** : flexion of neck & elevation of 1st rib.

* **Relations** :

- one nerve : the phrenic
 - 2 arteries : tr. cervical & subclavian
 - 2 veins : int. jugular & subclavian
 - 2 muscles : sternomastoid & omohyoid
- (A) anteriorly : roots of Br. plexus, 2nd part of subclav. a., scalenus med. m. & apex of lung.
- (B) posteriorly : trunks of Br. plexus & 3rd part of subclavian a.
- (C) laterally : 1st part of subclavian a., vertebral a., thyrocervical a. & sympathetic chain.



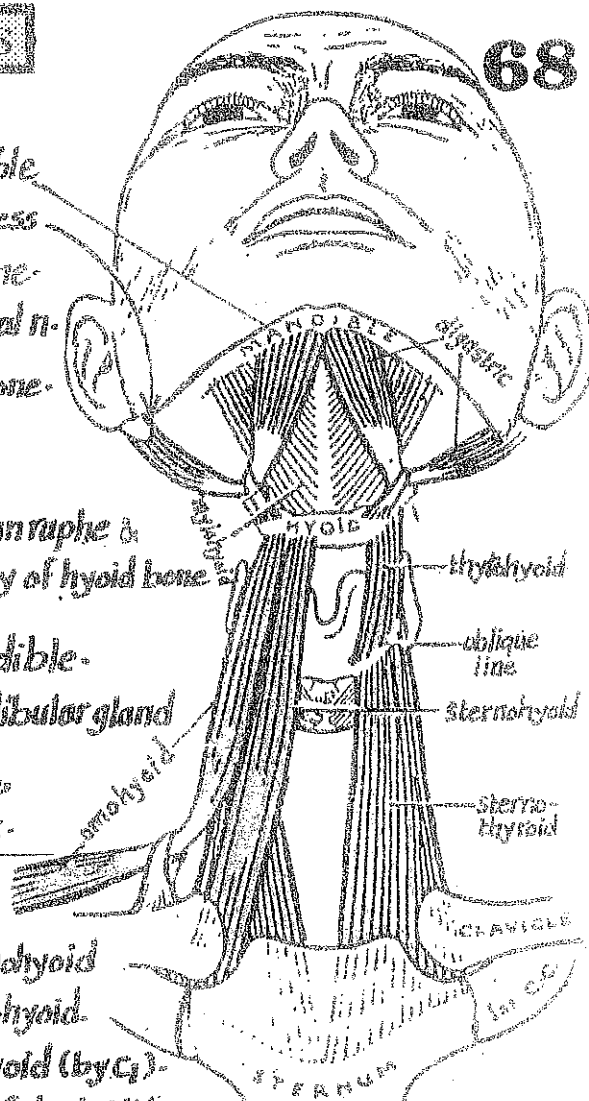
3- SUPRAHYOID MUSCLES

(1) Digastric m.:

- * Origin:
 - ant. belly: digastric fossa of mandible
 - post. belly: med. surface of mastoid process
- * Insertion: intermediate tendon connected to hyoid bone.
- * N. Supply: (a) ant. belly: mandibular n., post. belly: facial n.
- * Action: depression of mandible & elevation of hyoid bone.

(2) Mylohyoid m.:

- * Origin: mylohyoid line of mandible
- * Insertion: median raphe & body of hyoid bone
- * N. supply: n. to mylohyoid (from mandibular n.).
- * Action: elevation of hyoid bone & lowering of mandible.
- * Superficial relations: ant. belly of digastric & submandibular gland
- * deep relations: hyoglossus m., lingual n., hypoglossal n., deep part of submandib. gland & its duct.



4- INTRAHYOID MUSCLES

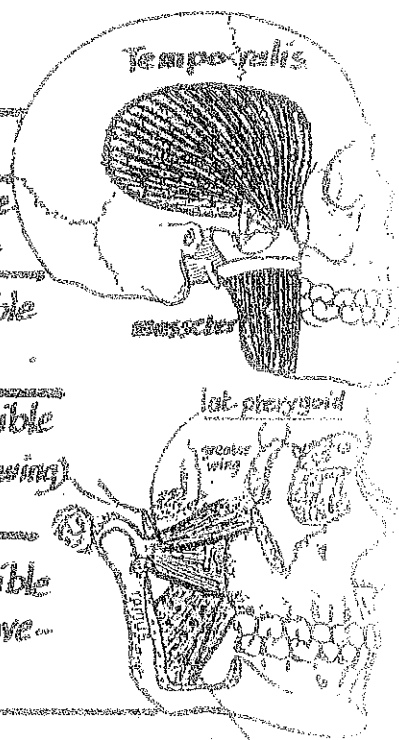
- * they are 4 mm. on each side:
 - 2 superficial: sternohyoid & omohyoid
 - 2 deep: sternothyroid & thyrohyoid.

- * N. Supply: all by ansa cervicalis (C1,2,3) except thyrohyoid (by C1).
- * Action: all depress the hyoid bone in the 2nd phase of deglutition.

Muscle	omohyoid	sternohyoid	Sternothyroid	thyrohyoid
<u>origin</u>	Sup. belly: body of hyoid inf. belly: upper border of scapula	back of manubrium	back of manubrium	oblique line of thyroid cartilage
<u>insert.</u>	intermediate tendon connected to clavicle by fibrous sling.	body of hyoid bone	oblique line of thyroid cartilage.	hyoid bone

5- MUSCLES OF MASTICATION

Muscle	Origin	Insertion	N.S	Action
1- Temporalis	temporal fossa of the skull	Coronoid process of mandible	ant. division of mandib. n. main trunk of mandib. n.	(1) elevates mandible (2) retracts "
2- Masseter	zygomatic arch of mandible	outer surface of ramus of mandible		(1) elevates mandible (2) protrudes "
3- Lateral pterygoid	greater wing of sphenoid & lat. pterygoid plate	neck of mandible		(1) lowers mandible (2) side to side (chewing) movement
4- Medial pterygoid	maxillary tuberosity & lat. pterygoid plate	inner surface of ramus of mandible		(1) elevates mandible (2) side to side movement.



TRIANGLES OF THE NECK

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* The antero-lateral aspect of the neck is divided by sternomastoid m. into 2 main triangles: ant. & post.

(A) Post triangle

* **Boundaries** :- anteriorly: post. border of sternomastoid m.

- posteriorly: ant. border of trapezius m.
- Apex (above): meeting of the ant. & post. borders.
- base (below): formed by the middle $\frac{1}{3}$ of clavicle.

* **Roof** : (1) skin.

- (2) superficial fascia containing
- platysma
 - ext. jugular v.
 - cutaneous brs. of cervical plexus

(3) deep fascia.

* **Floor** : formed of the following muscles (arranged from above downwards):

- (1) splenius capitis (2) levator scapulae. (3) scalenus medius

* **Contents** :

Muscle	Arteries	Veins	Nerves
inf. belly of omohyoid it divides the post. Δ into: (a) large occipital Δ above & (b) small subclavian Δ below	(1) 3rd part of subclavian a. (2) 2nd part of occipital a. (3) 2 brs. of 1st part of subclavian a.: (a) tr. cervical a. (b) suprascapular a.	(1) subclavian v. which has one tributary: the ext. jugular v.	(1) Accessory n (2) brachial plexus (trunks) (3) cutaneous brs. of the cervical plexus

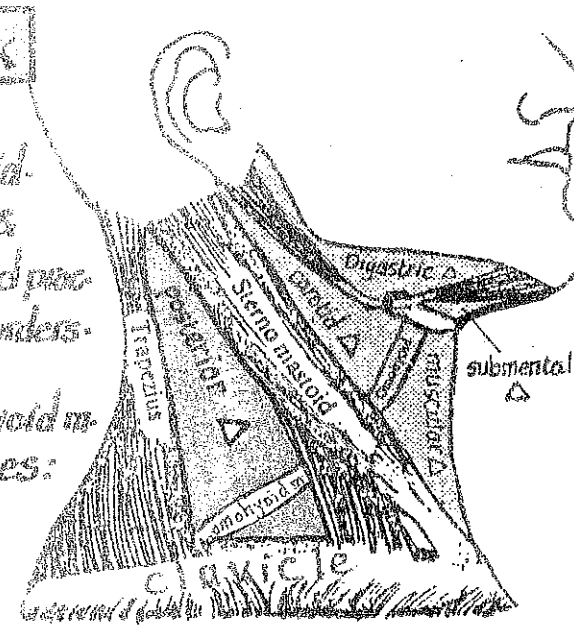
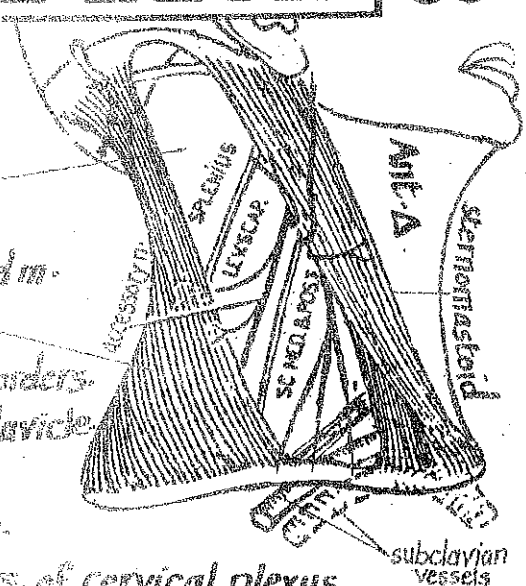
(B) Anterior Δ of neck

* **Boundaries** :- anteriorly: middle line of the neck.

- posteriorly: ant. border of sternomastoid.
- base (above): lower border of mandible & a line between angle of mandible & mastoid proc.
- Apex (below): meeting of the ant. & post. borders.

* **Subdivisions** : the digastric m. & sup. belly of omohyoid m. subdivide the ant. Δ into $3\frac{1}{2}$ triangles:

- (1) the digastric Δ
- (2) " carotid Δ .
- (3) " muscular Δ .
- (4) $\frac{1}{2}$ submental Δ .



1-Digastric Δ

* Boundaries : above : lower border of mandible
below : ant. & post. belly of digastric.

* Floor : mylohyoid & hyoglossus muscles.

* Roof : (1) skin.
(2) superficial fascia containing: (a) platysma
(b) cervical br. of facial n. (c) ant. facial v.
(3) deep fascia.

* Contents : - submandibular salivary gland & L.Ns
- facial a. & common facial v.
- hypoglossal n., lingual n. & submandib. ganglion.

2-Submental Δ

Boundaries : - on each side : ant. belly of digastric m.
- base : body of hyoid bone.
- apex : symphysis menti.

Floor : mylohyoid m. * Roof : skin & fascia

Contents : submental L.Ns & submental vessels.

3-Muscular Δ

Boundaries : anteriorly : middle line of neck.
- posterosuperiorly : sup. belly of omohyoid.
- posteroinferiorly : ant. border of sternomastoid.

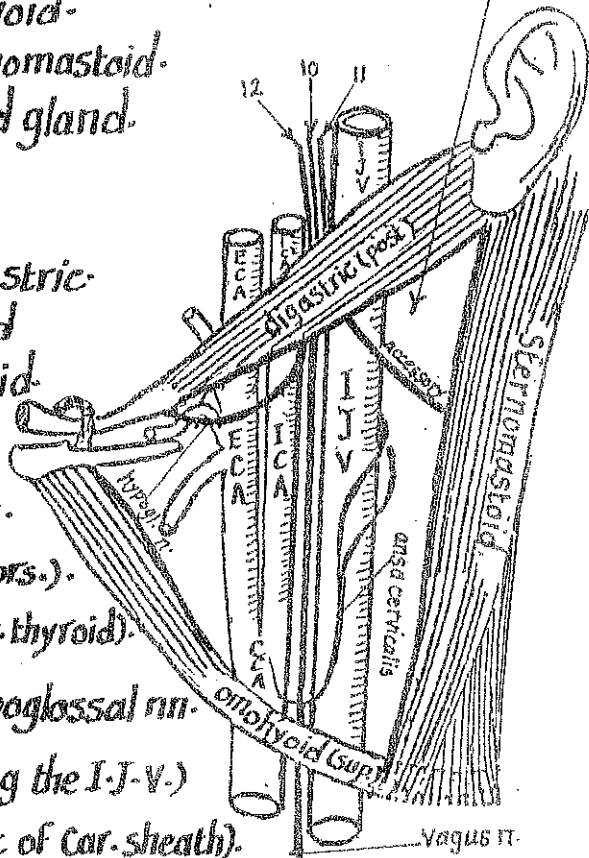
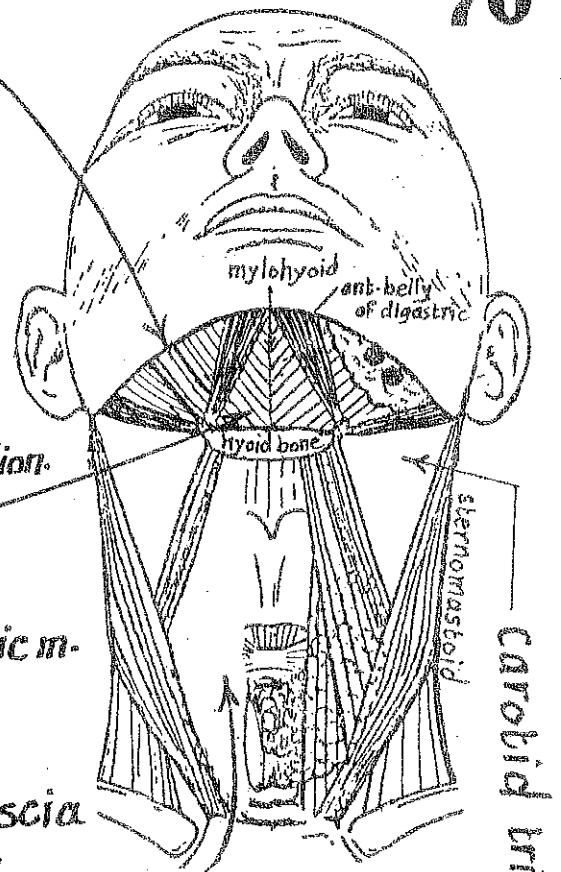
Contents : infrahyoid muscles & lat. lobe of thyroid gland.

(4) Carotid Δ

* Boundaries
- superiorly : post. belly of digastric.
- inferiorly : sup. belly of omohyoid
- post. : ant. border of sternomastoid.

* Contents : carotid sheath & its contents :

- (1) the 3 carotid arteries (C.C.A, E.C.A & I.C.A) & all brs.
of E.C.A except 3 (post. auricular a. & the 2 terminal brs.).
- (2) I.J.V & 3 of its tributaries (comm. facial, lingual & sup. thyroid).
- (3) the last 3 cranial nerves : vagus, accessory & hypoglossal nn.
- (4) 3 other structures : (a) deep Cervical L.Ns (along the I.J.V.)
(b) ansa Cervicalis n. (in front of Car. sheath).
(c) the Cervical Sympathetic chain (behind Carotid sheath).



GLANDS OF H&N

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1- THYROID GLAND

* Site : in the lower part of front of neck in the muscular triangles.

* Shape : butter-fly, formed of 2 lat. lobes connected by an isthmus.

- each lat. lobe is pear-shaped with its apex reaching oblique line of thyroid cartilage & base reaching the 5th or 6th tracheal ring.

- the isthmus crosses the 2nd, 3rd & 4th tracheal rings & may project upwards forming the pyramidal lobe which is connected to hyoid bone by fibrous band.

* Capsules : (1) true fibrous capsule enveloping the gland.

(2) false fascial capsule derived from pretracheal fascia which is attached above to thyroid cartilage & hyoid bone (so it allows the gland to move up during deglutition). The fascia is thickened posteriorly forming the ligament of Berry which fixes the back of the gland to the cricoid cartilage.

N.B: the big vessels of the gland run between the previous 2 capsules.

* Surfaces & relations :

(1) ant. surface of isthmus : related to

{ skin, superficial fascia
containing ant. jugular v.
deep fascia & st. thyroid m.

(2) post. surface : related to trachea (2nd, 3rd & 4th rings).

(3) post. surface of each lobe : related to 2 glands & 2 arteries:

- the sup. & inf. parathyroids, comm. carotid & inf. thyroid aa.

(4) ant-lat. surface of each lobe : related to skin, fascia & 4 muscles : sternothyroid, sternohyoid, omohyoid & sternomastoid.

(5) med. surface of each lobe : related to tubes & nerves :

(a) in the upper part : larynx, pharynx & ext. laryngeal n. in between.

(b) in the lower part : trachea, oesophagus & recur. laryn. n. in between.

* Arterial Supply :

(1) sup. thyroid a. : br. of ext. carotid a., closely related to ext.

laryngeal n. but separates from it close to the apex of the gland.

it supplies the upper 1/3 of the lat. lobe & upper 1/2 of the isthmus.

(2) inf. thyroid a. : br. of thyrocervical trunk of subclavian a.

Its terminal brs. are related to R-laryng. n. close to the gland.

It supplies the lower 2/3 of the lobe & lower 1/2 of the isthmus

(3) thyroid ima. a. (may be absent) : arises from arch of aorta

or innominate a. & ascends in front of trachea to reach the isthmus.

* Venous drainage :

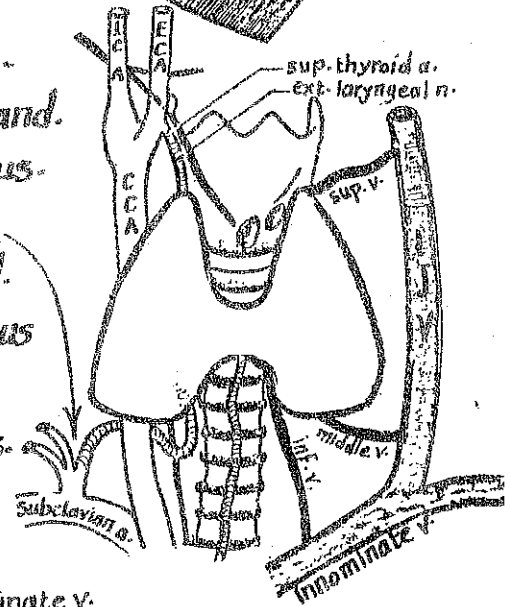
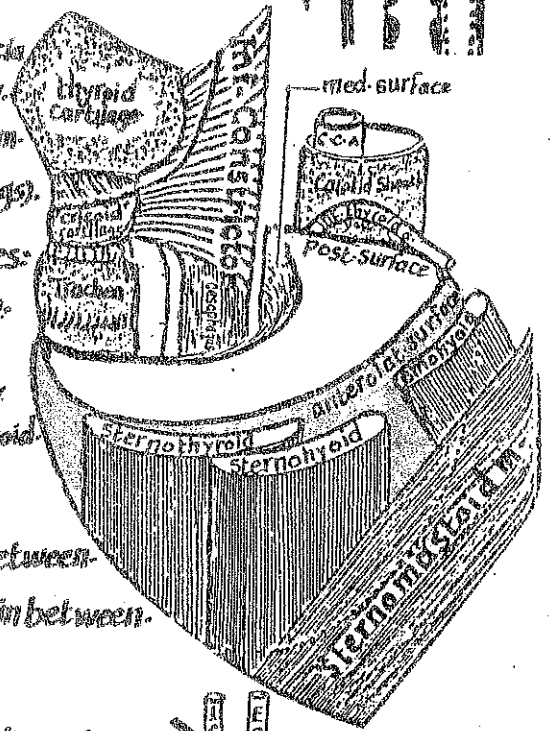
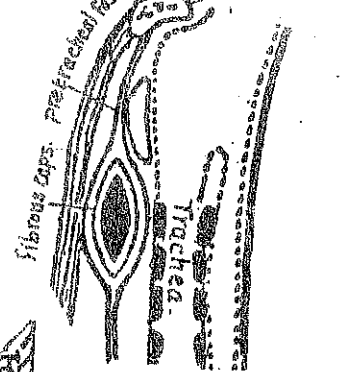
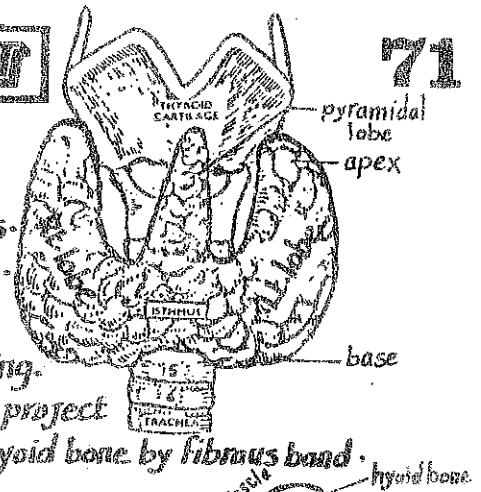
(1) sup. thyroid v. from apex

(2) middle » » from base

(3) inf. thyroid v. : from the isthmus

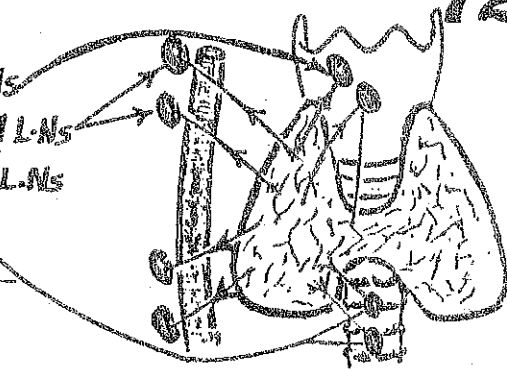
to I. J. V

innominate v.



* Lymphatic drainage: the lymphatics form an extensive plexus

- (a) ascending lymphatics passing $\begin{cases} \nearrow \text{medially to prelaryngeal L-Ns} \\ \searrow \text{laterally to upper deep cervical L-Ns} \end{cases}$
- (b) descending lymphatics passing $\begin{cases} \nearrow \text{laterally to lower deep cervical L-Ns} \\ \searrow \text{medially to pretracheal L-Ns} \end{cases}$



* Nerves related to the thyroid & effects of their injury:

Nerve	Function	effect of unilat. injury	Effect of bilateral injury
Ext. laryngeal n. (br. of sup. laryng. br. of vagus)	motor to cricothyroid m. (tensor of vocal cords)	change in the pitch of voice which is gradually compensated	- loss of high pitched voice & inability to change the pitch of voice
Recurrent laryn. n. (br. of vagus n.)	- motor to all laryngeal muscles except cricothyroid - sensory to mucous memb. below the vocal cords.	hoarseness of voice & dyspnea on exertion. The hoarseness gradually disappears when the other cord crosses middle line to meet the paralysed cord	- <u>Complete injury</u> : aphonia & dyspnea on exertion - <u>incomplete injury</u> $\rightarrow$ stridor i.e. the most serious injury!!

2- SUBMANDIBULAR GLAND

* Site: in the digastric (submandibular) triangle, partly below & partly deep to the mandible.

* Parts: superficial part, deep part & submandibular duct.

(A) the superficial part: is wedge-shaped extending

- posteriorly: to the angle of mandible
- superiorly: to mylohyoid line of mandible
- inferiorly: it overlaps the 2 bellies of digastric m.

• Relations:

- (1) Inferolateral surface: related to skin, superficial fascia containing platysma, cervical br. of facial n., ant. facial V., L-Ns) & deep fascia.
- (2) lateral surface: related to body of mandible, facial a., mylohyoid n. & artery
- (3) medial surface: related to 2 muscles (mylohyoid & hyoglossus) & 2 nerves (lingual & hypoglossal).

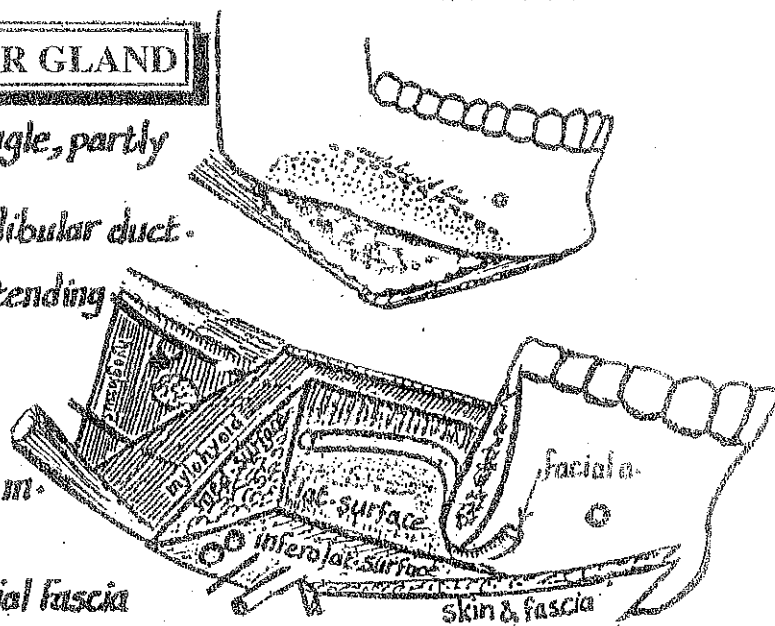
(B) the deep part: is a small part lying deep to mylohyoid & superficial to hyoglossus & between lingual n. above & hypoglossal n. below.

(C) Submandibular (Warton's) duct: is 5 cm long, has the following course & relations:

- it arises from the deep part & passes forwards between mylohyoid & hyoglossus, having tripple relations with the lingual n. (1st lat. to the n. then below it & finally med. to it).
- it ends by opening into the floor of mouth close to the frenulum of the tongue.

* N. supply: (a) parasymp.: chorda tympani (b) symp.: plexus around facial a. (c) sensory: lingual n.

* Lymphatic drainage: to submandibular & upper deep cervical L-Ns



3- PAROTID GLAND

- * It is the largest salivary gland & has serous secretion.
- * Site: below the auricle, between sternomastoid & ramus of mandible
- * Parts: (1) main part (2) accessory part (3) parotid duct.

I- Main Part

- * Surface anatomy: Connect the following 4 points:

(a) tragus of ear (b) centre of mastoid pr. (c) point 2 cm below & behind angle of mand (d) center

- * Shape: wedge-shaped having: (a) deep part (apex of the wedge)
(b) superficial part (base of the wedge)

- * Surfaces & relations:

(A) lateral Surface: related to skin & superficial fascia containing:
platysma, great auricular n. & superficial parotid L.Ns.

(B) postero-med. Surface:

- (1) mastoid process & 2 muscles attached to it — post. b. of digastric, sternomastoid
- (2) Styloid process & structures attached to it.
- (3) Carotid sheath & its contents (I.C.A., I.J.V. & the last 4 cranial nerves: 9, 10, 11 & 12).

(C) Antero-medial Surface: Clasps the 3 Ms:

- (1) Masseter (2) Mandible (ramus) (3) Med. pterygoid

- * Structures inside the gland (from superficial to deep):

- (1) facial n. & its 5 terminal brs.: divide the gland into 2 lobes.
- (2) retromandibular v.: formed inside the gland by union of 2 veins: maxillary & superficial temporal.
- (3) E.C.A.: the deepest structure. It divides inside the gland into 2 terminal brs.: maxillary a. & superf. temporal a.

* the upper end of the gland: related to auriculotemporal n., temporal br. of facial n., superficial temporal vessels & cartilagenous part of ext. auditory meatus

* the lower end of the gland: related to cervical br. of facial n., the 2 divisions of retromandibular v.

* the ant. border of the gland: gives exit to brs. of facial n. (zygomatic, buccal & mandibular), parotid duct & transverse facials.

II- Accessory part: a small, semidetached part between parotid duct & zygomatic arch.

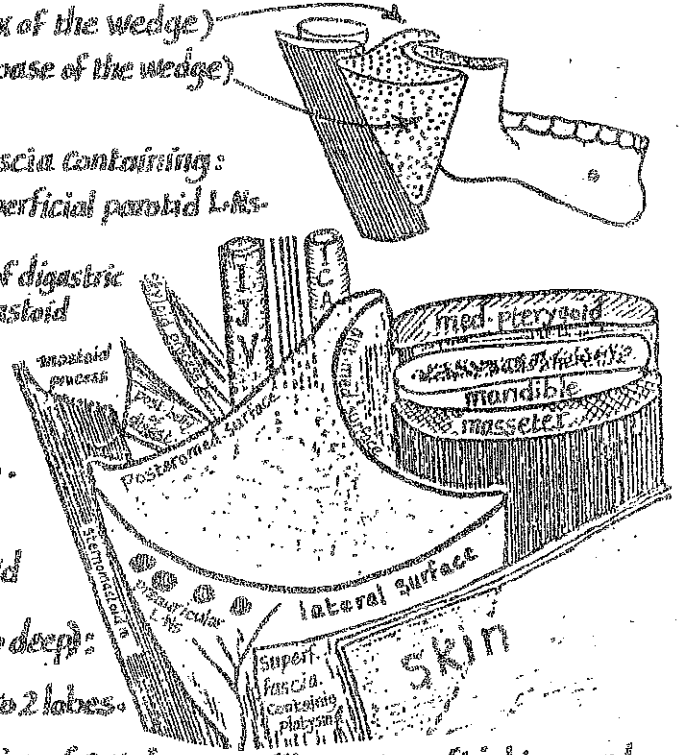
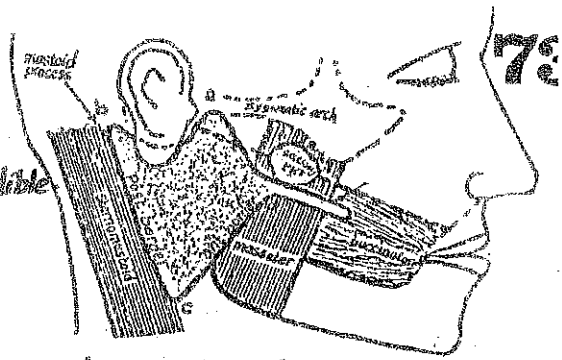
III- parotid (Stensen's) duct: 5 cm long, emerges from the ant. border, passes superficial to masseter then pierce buccinator to open in the vestibule of mouth opposite the upper 2nd molar tooth. Surface anatomy: middle $\frac{1}{3}$ of a line extending from tragus of ear to a point midway between ala of nose & angle of mouth.

* Capsule of the gland: tight fascial capsule derived from general investing d. fascia of neck.

* Arterial supply: ext. carotid a. inside the gland * Venous drainage: retromandibular v.

* N. supply: - parasymp.: glossopharyngeal n. - Symp.: plexus around E.C.A. - sensory: auric-temp

* Lymphatic drainage: into superficial & deep parotid L.Ns → upper deep cervical L.Ns.



THE TONGUE

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* It is a muscular organ covered by mucous memb. lying in the floor of mouth & oropharynx

* Parts:

- (1) root: the post. part through which pass the muscles connecting the tongue to the mandible & hyoid bone.
- (2) tip & margins: lie opposite gums & teeth
- (3) lower surface: applied to the floor of mouth & shows:
 - (a) frenulum: a raised fold of mucosa in the middle line
 - (b) deep lingual v.: one on each side of the frenulum
 - (c) fimbriated fold: a raised ciliated mucosal fold
- (4) Dorsum of tongue: is divided by a V-shaped groove called sulcus terminalis into 2 parts:

(A) Oral part (ant. 2/3)	Pharyngeal part (post. 1/3)
looks upwards towards the palate	look backwards towards pharynx
Contains papillae	no papillae
no lymphoid follicles	contains submucosal lymphoid follicles called lingual tonsils.

* Muscles of the tongue:

(A) Extrinsic muscles: have bony attachment & include 4 muscles:

- (1) Hyoglossus: O: hyoid bone. I: side of tongue. A: depresses tongue.
- (2) Styloglossus: O: styloid pr. I: side of tongue. A: pulls tongue backwards.
- (3) genioglossus: O: sup. genial tubercle. I: under surface. A: protrudes tongue.
- (4) palatoglossus: O: palatine aponeurosis. I: side of tongue. A: pulls upwards.

(B) Intrinsic muscles: have no bony attachment. They include: sup. & inf. longitudinal, vertical & transverse m. fibres. They change the shape of tongue.

* N. supply of tongue:

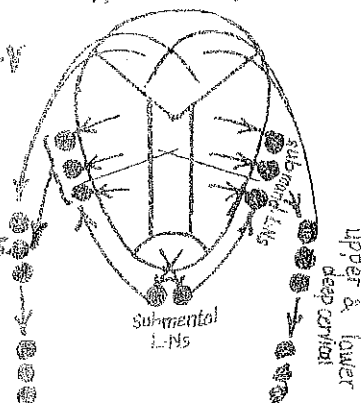
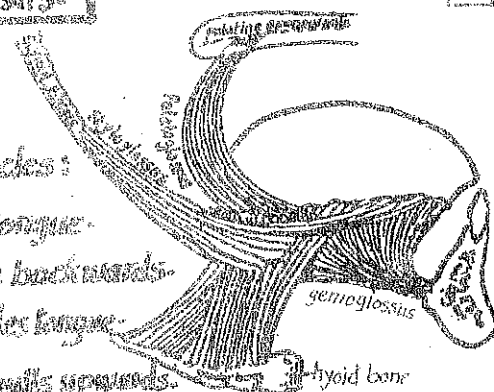
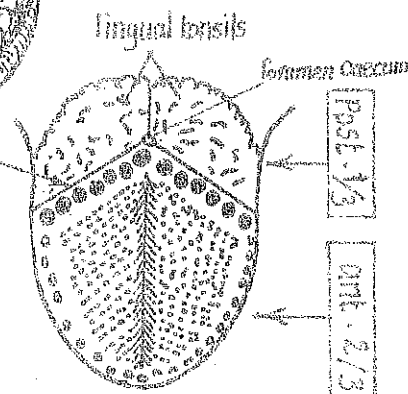
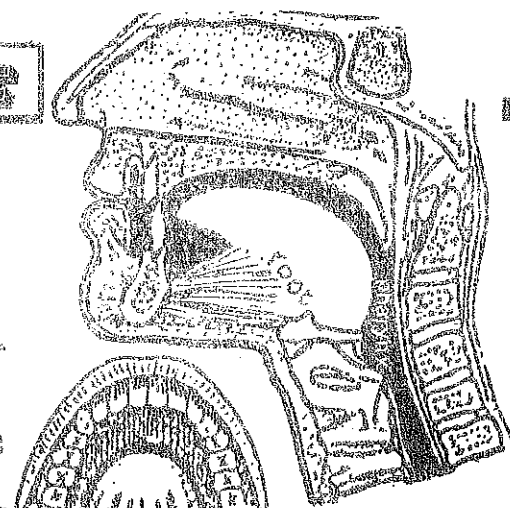
(A) Sensory Supply: ant. 2/3: lingual n. (general sens.) & chorda tympani (taste)
post. 1/3: glossopharyngeal n. carries all sensations.

(B) Motor supply: hypoglossal n. supplies all muscles except palatoglossus (supplied by vagus)

* Blood Supply: - Lingual a. (br. of ext. carotid a.) - Lingual v.: - I.J.V

* Lymphatic drainage: A- post. 1/3 → upper deep cervical L.Ns
B- ant. 2/3:

- (1) tip of tongue: submental L.Ns → submandibular L.Ns of both sides → deep cervical L.Ns
- (2) side of tongue: → ipsilateral submandibular L.Ns → ipsilateral deep cervical L.Ns (upper & lower).
- (3) Central part → submandibular L.Ns of both sides → upper & lower deep cervical L.Ns of both sides.



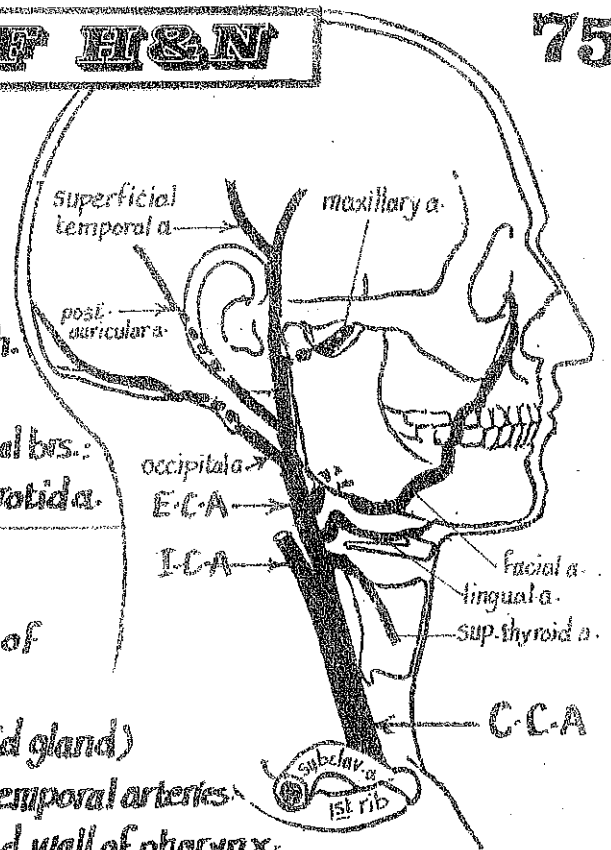
(1) Common Carotid a (C.C.A):

* Origin: Rt. C-C-A: arises from the innominate a.

L.C.G-A : arises from the arch of aorta.

*Course: each C-C-A enters the neck behind the sternoclavicular joint & ascends inside the carotid sheath.

* Termination: opposite the upper border of thyroid cartilage (C₃/C₄) by dividing into 2 terminal brs.:
(a) external carotid a. (b) internal carotid a.



(2) External Carotid a. (E.C.A.):

* Origin : at the upper border of thyroid cartilage as one of the 2 terminal brs. of C.C.A.

*Termination: behind neck of mandible (inside parotid gland)
by dividing into maxillary & superficial temporal arteries

* Course : ascends outside the carotid sheath, on the med. wall of pharynx.

* Branches :

from its ant.-aspect	from its post.-aspect	front med.-aspect	Terminal brs.
(1) sup. thyroid a. (2) lingual a. (3) facial a.	(4) occipital a. (5) post-auricular a.	(6) ascending pharyngeal a.	(7) superficial temporal. (8) Maxillary.

(3) Internal Carotid a. (I.C.A.):

* **Origin**: opposite the upper border of thyroid cartilage as the other terminal br. of CCA

* termination : inside the cranial cavity by dividing into ant-cerebral & middle cerebral arteries.

* Course: ascends inside the carotid sheath then enters the carotid canal of the skull to reach the cranial cavity. It gives No branches in the neck.

(4) Subclavian a.

4) Subclavian a. :
 * Origin : different on both sides :
 Rt. subclavian a. : arises from innominate a.
 Lt. " " : " " arch of aorta.

*Termination: at the outer border of 1st rib by becoming axillary a.

→ Course: it runs an arched course in the root of the neck, in front of apex of lung.
its course is divided into 3 parts:

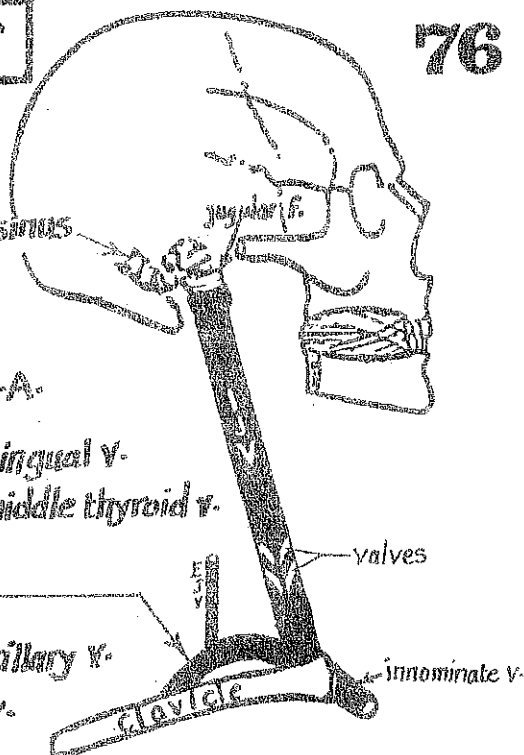
	1st part: med. to scalenus ant.	2nd part: behind S. ant.	3rd part: lat. to S. ant.
* <u>Branches:</u>	(1) <u>vertebral a.</u> (2) <u>thyrocervical a.</u> (3) <u>int. mammary a.</u>	(1) <u>Costocervical trunk</u> which divides into: a- deep cervical a. b- sup. intercostal a.	gives no branches

VEINS OF H&N

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(1) Internal jugular vein (I.J.V.):

- * Origin : at the jugular foramen as a continuation of sigmoid sinus
- * Termination : behind the med. end of the clavicle by joining the subclavian V. to form innominate vein.
- * Course : descends inside the carotid sheath lat. to I.C.A & C.C.A.
- * Tributaries : (1) inf. petrosal sinus (2) common facial v. (3) lingual v.
(4) pharyngeal veins (5) sup. thyroid v. (6) middle thyroid v.



(2) Subclavian V.:

- * Origin : at the outer border of 1st rib as continuation of axillary V.
- * Termination : by joining the I.J.V to form the innominate v.
- * Tributaries : it has one tributary : the external jugular v.

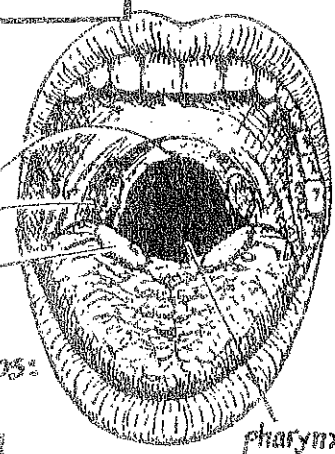
LYMPH DRAINAGE OF H&N

(A) Circular chain of LNs

I- Inner ring (Waldeyer lymphatic ring):

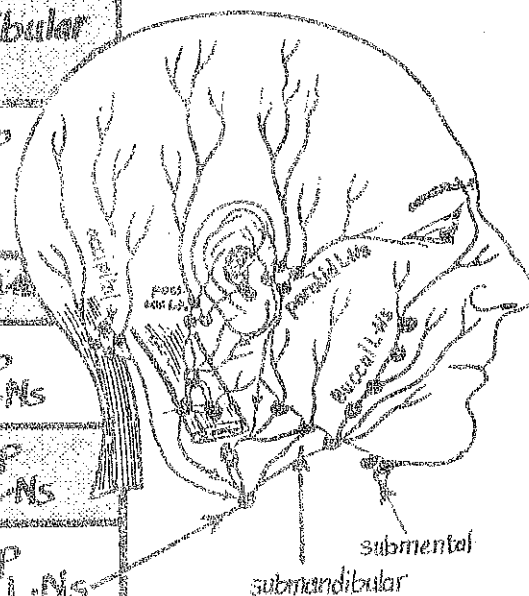
inside the mouth & pharynx and include it drains into the upper deep cervical L.Ns.

nasopharyngeal tonsil
palatine tonsils
lingual tonsils



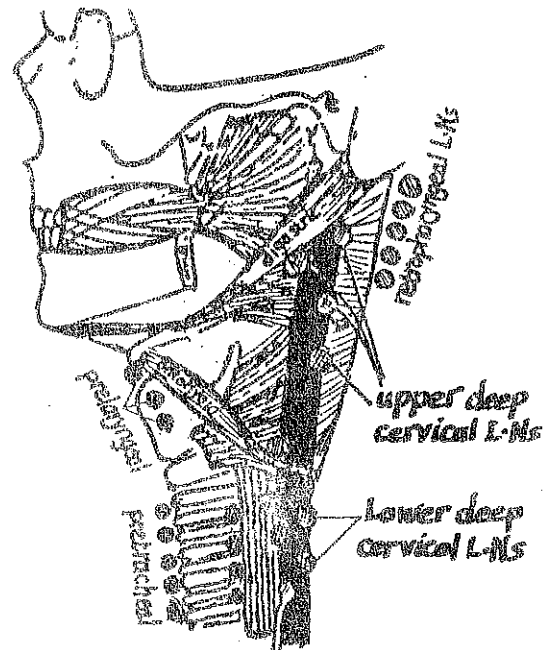
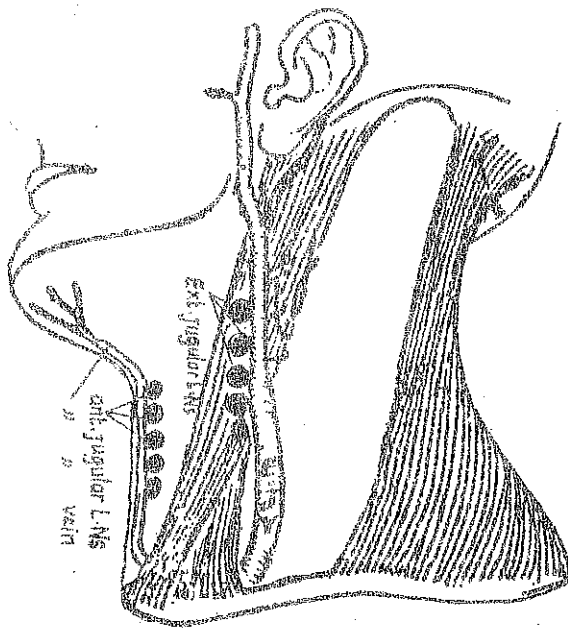
II- Outer ring: around the mandible, including the following groups:

Group	Site	afferents from	Efferents to
submental L.Ns	submental Δ	(1) tip of tongue (2) floor of mouth	submandibular L.Ns
submandibular L.Ns.	submandibular region	(1) most of the face (2) floor of mouth (3) side of tongue	upper deep cervical L.Ns
Buccal L.Ns	on buccinator m.	cheeks & lips	submandibular L.Ns
pre-auricular & parotid L.Ns	on parotid gland & inside it.	(1) temple & auricle (2) upper 1/2 of face	upper deep cervical L.Ns
pos-auricular L.Ns	on mastoid process	post. part of scalp & auricle	upper deep cervical L.Ns
occipital L.Ns.	at the apex of post. Δ of neck	post part of scalp & back of neck	upper deep cervical L.Ns



B- Vertical chain of L.Ns.

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L.N group	Site	Afferents from:	Efferents to:
1- Ext. Jugular (superficial cervical)	superficial to sterno mastoid along E.J.V.	lobule of ear, ext-auditory meatus & parotid gland.	upper & lower deep cervical L.Ns.
2- Ant. jugular (ant. cervical)	along the ant. jug. V. mainly above sternum	ant. region of neck below hyoid bone.	upper deep cervical, pre-tracheal L.Ns
3- Pre-laryngeal	in front of larynx	larynx	upper & lower deep cervical L.Ns
4- pre-tracheal	along inf. thyroid vr.		
5- paratracheal	alongside trachea & oesophagus	(1) larynx & pharynx (2) trachea & oesophagus (3) thyroid gland.	" "
6- retropharyngeal	behind pharynx	nasopharynx, auditory tube & paranasal sinuses.	upper deep cervical L.Ns.

7- upper deep cervical L.Ns :

- lie along the upper part of I.J.V deep to sternomastoid m.
- the most important member of this group is the jugulo-digastric L-N lying in the angle between I.J.V. & post-belly of digastric. It drains the tonsil
- the upper deep cervical L.Ns send their efferent lymphatics to the deep cervical L.Ns

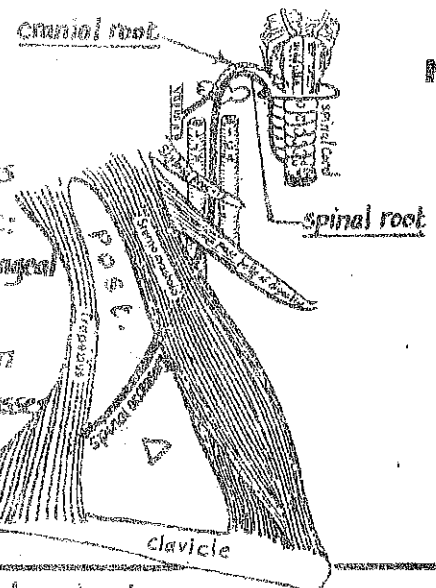
8- Lower deep cervical L.Ns.

- lie along the lower part of I.J.V. deep to sternomastoid & include the following
 - (a) jugulo-omohyoid L-N in the angle between I.J.V & intermediate tendon of omohyoid. It is concerned with the lymphatic drainage of the tongue.
 - (b) supraclavicular L.N. : the Lt. one is enlarged in abd. & bronchial carcinoma (Troisier sign).

* Efferents : from the upper & lower deep cervical L.Ns collect to form Jugular Lymph trunk which ends in the thoracic duct (on Lt. side) or Rt. lymphatic duct (Rt. side).

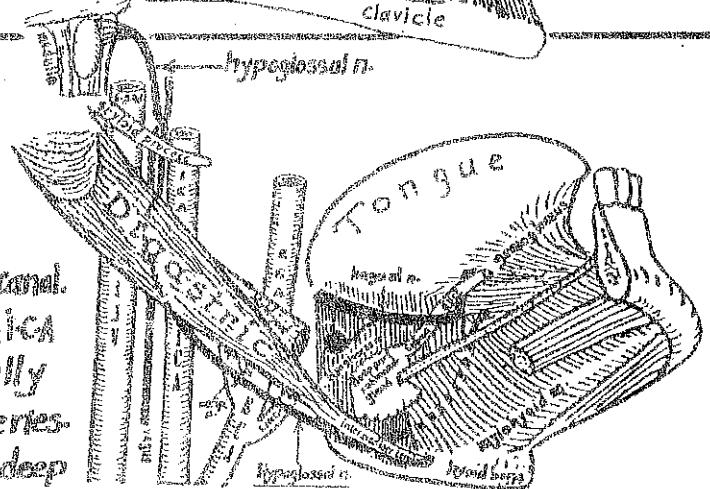
(3) Accessory n. (11th nerve)

- Origin : by 2 roots
 - ◀ cranial root : from medulla
 - ◀ spinal root : from upper 5 cervical segments
- Course : it emerges from the jugular f. then the 2 roots separate:
 - (1) the cranial root : joins the vagus n. & is distributed with its pharyngeal & laryngeal branches.
 - (2) the spinal root : descends first in the Carotid sheath (between I.C.A. & I.J.V) then emerges from the sheath, passes backwards, to pierce sternomastoid, crosses the post. Δ of neck to end in the trapezius. It supplies both muscles



(4) Hypoglossal n. (12th or n.)

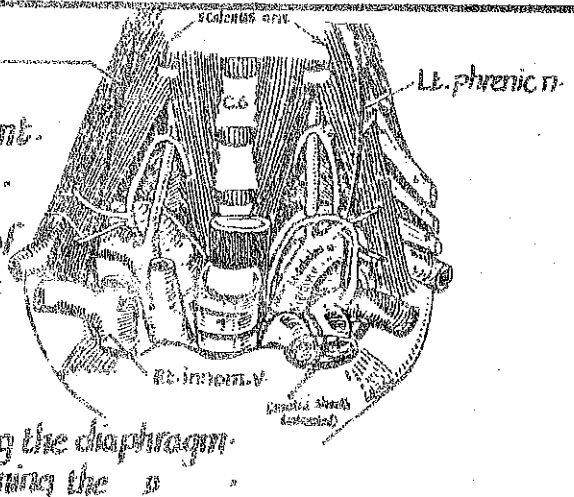
- * Origin : it is a motor n. arising from medulla.
- * Course :
 - it emerges from the ant. condylar (hypoglossal) canal.
 - it descends in the carotid sheath between I.J.V & I.C.A
 - it leaves the sheath & passes forwards & medially crossing : I.C.A., E.C.A., occipital & lingual arteries.
 - it enters the digastric Δ lying on hyoglossus deep to submandib. salivary gland (below lingual n. & the submandibular duct).
 - finally, it passes deep to mylohyoid to reach the tongue where it breaks into terminal branches.
- * Branches : (a) hypoglossal n. itself : supplies all muscles of tongue except palatoglossus m.
 (b) fibres of C1 joining it : descendens hypoglossi, n. to thyrohyoid & n. to geniohyoid.



(5) Phrenic n. (C3, 4, 5)

- in the neck : it descends obliquely in front of scalenus ant. & covered superficially by sternomastoid m.
- in the thorax : it enters the thorax by crossing in front of 1st part of subclavian a. then descends on the lat. aspect of pericardium to reach the diaphragm.

- * Branches
 - ◀ motor to the diaphragm
 - ◀ sensory to the "3 Ps"
 - pericardium
 - pleura covering the diaphragm
 - peritoneum lining the



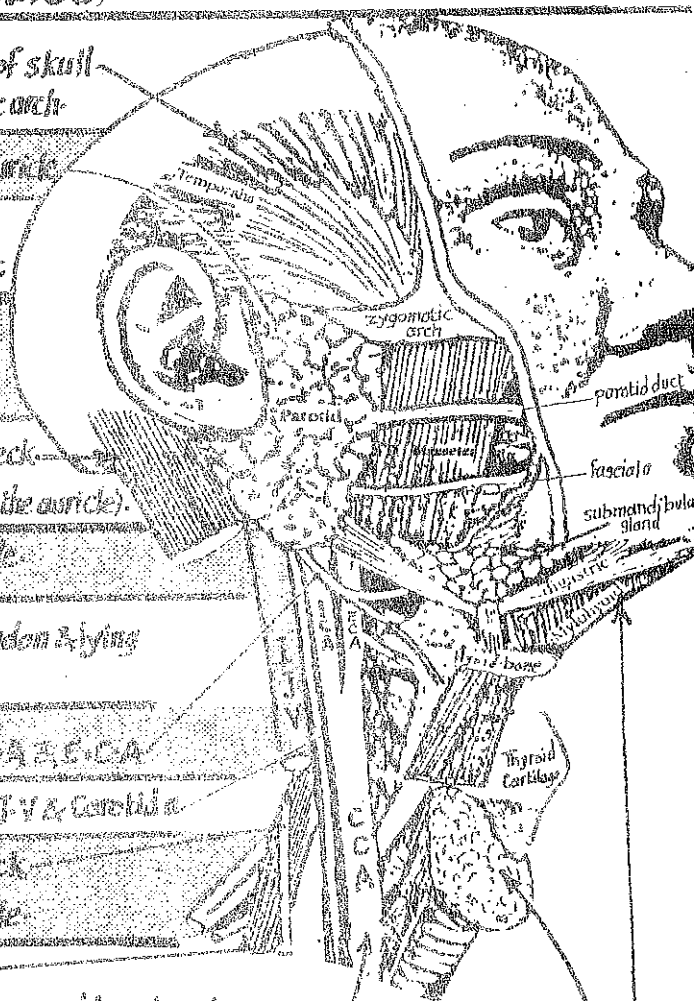
Summary of the N. Supply of the H&N

- all facial muscles are supplied by facial n. except levator palpebrae sup. (by oculomotor n.)
- all muscles of mastication ◦ ◦ ant. division of mandib. n. except med. pterygoid (by main trunk).
- ◦ larynx are supplied by recurrent laryn. n. except cricothyroid (by ext. laryngeal n.).
- ◦ pharynx ◦ ◦ ◦ vagus except stylopharyngeus (by glossopharyngeal n.)
- ◦ tongue ◦ ◦ ◦ hypoglossal n. except palatoglossus (by vagus).
- all infrahyoid muscles are supplied by ansa cervicalis except thyrohyoid (by C1).

SPOTTING OF THE MAN

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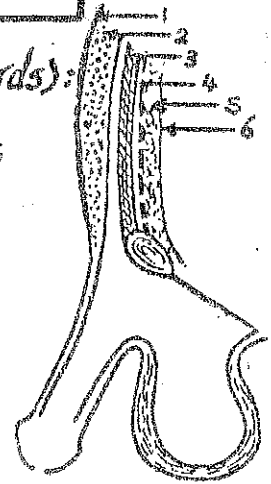
Structure	Identifying feature(s)
Temporalis m.	- fan-shaped m. attached to the temporal fossa of skull - its tapering tendon passes deep to the zygomatic arch
Parotid Gland	- a lobulated structure just in front & below the ear
parotid duct	- the thickest structure emerging from the ant. border of parotid & passing forwards on masseter.
Masseter m.	- lying just in front of parotid gland & attached above to the zygomatic arch
Sternomastoid m.	- the longest & thickest m. in the side of the neck - it is attached above to mastoid process (behind the auricle).
submandibular gland	- a lobulated structure just below the mandible
Digastric m.	- has 2 bellies (ant. & post.) & intermediate tendon & lying just below the submandibular gland
Hypoglossal n.	- an arched n. below the mandible crossing I.C.A. & E.C.A.
Vagus n.	- a vertical n. descending in the neck between I.J.V. & Carotid a.
phrenic n.	- a vertical n. starting at the middle of the neck & descending in front of scalenus ant. muscle
Scalenus ant. m.	- a muscle in the lower part of side of neck - in front of the roots of the brachial plexus & crossed by phrenic n.
Common Carotid a.	- a large vessel on the side of neck under cover of sternomastoid - dividing above into internal & external carotid arteries.
Int. Carotid a.	- the post. division of C.C.A. & gives no branches in the neck
Ext. " "	- the ant. division of C.C.A. & gives many branches in the neck
Int. Jugular v.	- a thin-walled wide vessel under cover of sternomastoid & behind the carotid arteries
thyroid gland	- a butter-fly gland in the lower part of front of neck in front of upper part of trachea
rec. laryngeal n.	- a slender n. in the groove between trachea & oesophagus (one on each side).
mylohyoid m.	- a muscle just below the chin between the 2 ant. bellies of RL & LL digastric muscles
sternohyoid m.	- a paramedian m. covering thyroid gland & attached above to the hyoid bone.
omohyoid m.	- lies just lat to sternohyoid
sternothyroid m.	- lies deep to both omohyoid & sternohyoid & attached above to thyroid cartilage.



A. ANT. ABDOMINAL WALL 81

* Structure: it is formed of the following layers (from outside inwards):

- (1) skin (2) superficial fascia (3) abdominal muscles
- (4) fascia transversalis (5) extraperitoneal fatty tissue
- (6) parietal layer of peritoneum.



(A) Skin of abdominal Wall

* it is thin & presents :

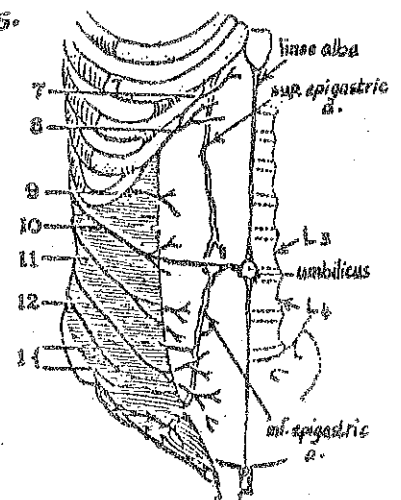
- (1) pubic hairs : in females the hair is limited to the pubic region, in males a strip of hairs extends up to the umbilicus.
- (2) the umbilicus : lies in the centre of the ant. abdominal wall.

The Umbilicus

* Definition : it is a depressed wrinkled scar formed by the separation of the stump of the umbilical cord after birth.

* Position : it lies in the linea alba in the ant.-middle line at the level of the disc between the 3rd & 4th lumbar vertebrae.

* N. supply : it is supplied by T10 (as the appendix).



(B) Fascia of ant. abdominal Wall

(1) There is no deep fascia in the ant.-abdominal wall.

(2) The superficial fascia differentiates, particularly below the umbilicus, into 2 layers:

(A) Superficial Fatty layer (Camper's fascia) which is continuous with the superficial fascia of the adjoining parts of the body.

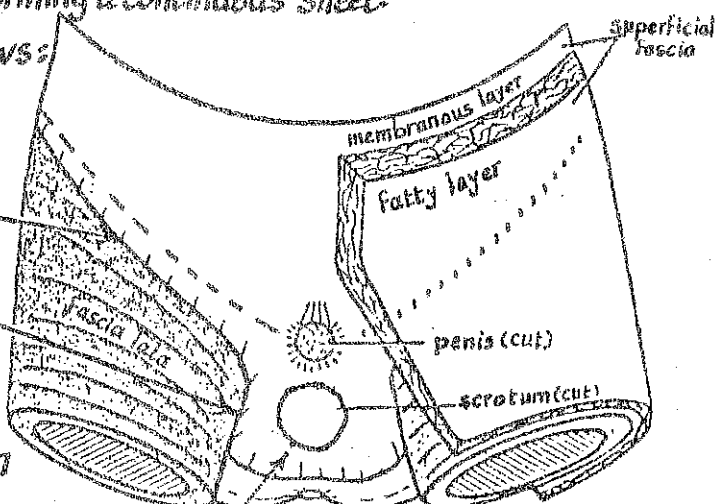
(B) Deep membranous layer (Scarpa's fascia):

* it is well defined below the umbilicus forming a continuous sheet.

* its lower border is attached as follows:

- (1) lateral to each pubic tubercle : it is attached to the fascia lata of thigh a finger breadth below the inguinal lig.
- (2) medial to pubic tubercle : it is attached to the pubic arch & tubercle.
- (3) in the median plane it gives a tubular like envelope around the penis & scrotum

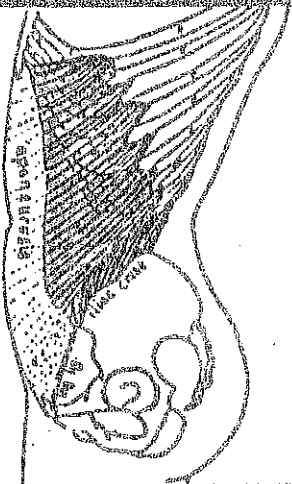
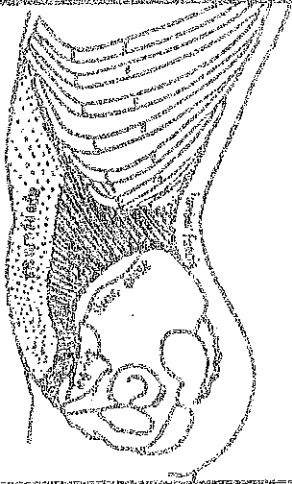
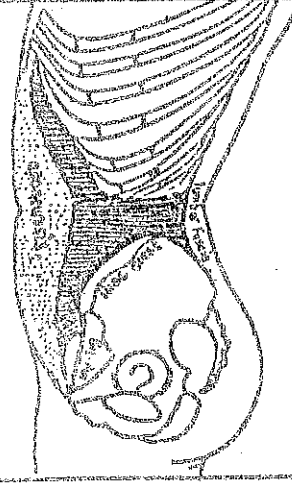
then extends backwards into the perineum forming the Colles' fascia.



C- Muscles Of Anterior Abdominal Wall.

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A- The 3 Flat anterolateral abdominal muscles:

	1-Ext. abd. oblique	2-Int. abd. oblique	3-Transversus abd.
			
General organization	Forms the outer layer of the 3 muscles	Forms the middle & thickest layer of the 3 muscles	Forms the inner & thinnest layer of the 3 muscles
Origin	has <u>one</u> site of origin: <u>Costal</u> : from the ribs.	has <u>2</u> sites of origin: (1) <u>lumbar</u> : from lumbar fascia (2) <u>ilioinguinal</u> : from iliac crest & inguinal lig.	has <u>3</u> sites of origin: (1) <u>Costal</u> origin. (2) <u>lumbar</u> origin. (3) <u>ilioinguinal</u> origin.
Direction of fibres	the 3 muscles have 3 different directions (to strengthen the ant. abd. wall). Fibres are directed mainly downwards, forwards & medially		
	Fibres are directed mainly upwards, forwards & medially	Fibres are directed mainly transversely forwards.	
Insertion	the 3 muscles develop 3 broad aponeuroses towards the median plane. These aponeuroses help in formation of a sheath for the rectus abdominis m. then become inserted mainly in the linea alba which is a fibrous band in the ant-middle line extending from the xiphoid process to the symphysis pubis.		
N. Supply	lower 6 thoracic & 1st lumbar nerves.		

* Important points about the 3 Flat muscles

(1) Linea alba:

* Definition: it is a strong tendinous raphe in the middle line of the ant. abd. wall (between the 2 recti). It is formed by the interlacing fibres of the aponeuroses of the oblique & transversus muscles of both sides

* Attachments: Above: attached to xiphoid process, below: attached to symphysis pubis.

* Characters: (1) it shows the umbilical scar in its middle (2) below the umbilicus it is narrow. (3) above the umbilicus it is wide (1½ cm) & it is a bloodless line.

(2) The Inguinal (Poupart's) ligament:

* It is the thickened lower border of the ext. abd. oblique aponeurosis.

* it is attached to the pubic tubercle medially & A.S.I.S. laterally.

* it has 2 extensions:

(1) reflected part: runs upwards & medially behind the spermatic cord to get attached to the linea alba. It reinforces the med. $\frac{1}{4}$ of the post-wall of the inguinal canal.

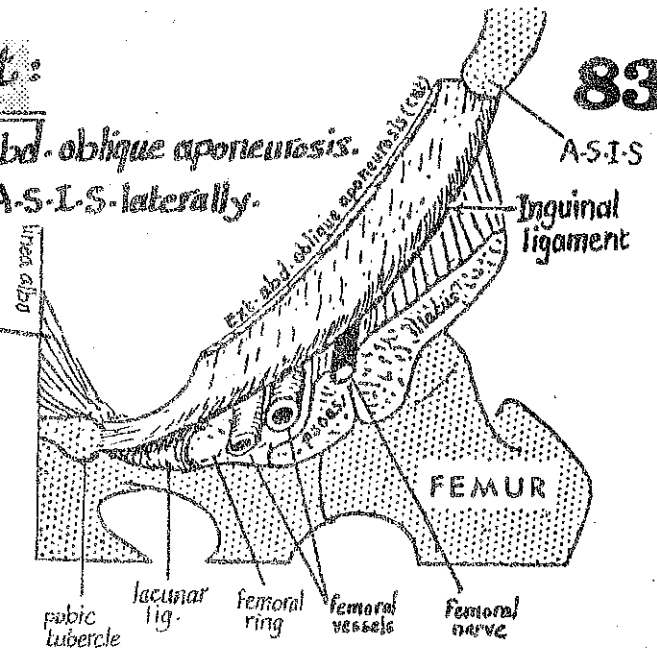
(2) lacunar lig.: it is a triangular extension from the med. end of the inguinal lig., having:

(a) apex: attached to the pubic tubercle.

(b) base: forming the sharp crescentic med. border of the femoral ring.

(c) ant. border: continuous with the med. end of the inguinal ligament.

(d) post. ": attached to the pectineal line of the sup. pubic ramus.



(3) Conjoint tendon:

* It is an aponeurotic band formed by fusion of:

(a) the lowermost arching fibres of transversus abdominis m.

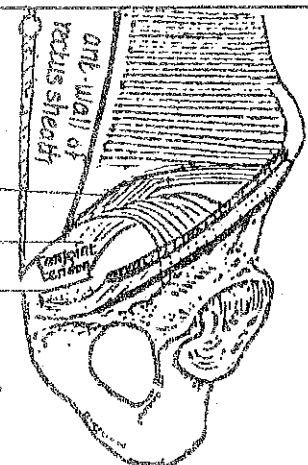
(b) " " " " " " internal abd. oblique m.

* it is attached to pubic crest & med. part of pectineal line.

* medially, it is fused with the ant-wall of the rectus sheath.

* N-supply: ilioinguinal n. (may be cut in Mac Burney's incision).

* Surgical importance: Conjoint tendon forms the med. $\frac{1}{2}$ of the post-wall of the inguinal canal & its weakness predisposes to direct ing. hernia.



(4) Fascia transversalis:

- Definition: It is a thin fascia which lines the inner surface of transversus abd. m. & is separated from peritoneum by fatty tissue.

- Extent: above: it is continuous with the diaphragmatic fascia.

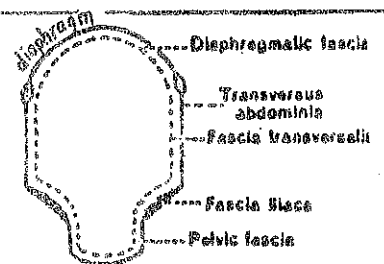
• posteriorly: " " " renal fascia

• inferiorly: it has the following attachments:

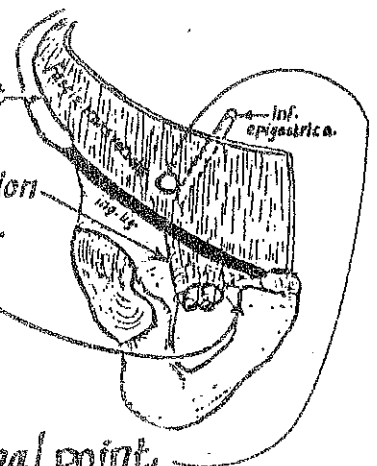
(a) lat. to ext. iliac vessels: it is attached to inner lip of iliac crest & lat. $\frac{1}{2}$ of ing. lig. (being continuous with fascia iliaca at these sites).

(b) over the ext. iliac vessels: it sends a downward prolongation into the thigh (forming the ant-wall of the femoral sheath).

(c) med. to the ext. iliac vessels: it is attached to pectineal line & pubic crest (blending with the pelvic fascia).



- The deep inguinal ring: is an opening in fascia transversalis lying $\frac{1}{2}$ an inch above the mid inguinal point.



B-Rectus abdominis m.

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- * Origin: from the pubic crest & front of symphysis pubis
- * Insertion: into the front of the 5th, 6th, 7th costal cartilages & the xiphoid process.
- * N. supply: lower 6 thoracic nerves. * Action: flexion of the trunk.

* Important features:

- (1) it is divided into segments by 3-4 tendinous intersections.
- (2) its lateral border is called linea semilunaris.
- (3) each rectus m. is enclosed in a fibrous sheath called the "Rectus sheath"

Rectus sheath

- * It is an aponeurotic sheath enveloping the rectus & pyramidalis muscles (and their associated vessels & nerves) & is formed by the aponeuroses of the 3 flat abd. muscles.

* Structure (formation): the sheath has 3 parts:

(A) Upper part (above the level of the costal margin):

- post-wall: is formed by costal cartilages only.
- ant-wall: is formed by the ext. oblique aponeurosis

(B) Middle part (from the costal margin to a line midway between umbilicus & s. pubis):

- post-wall: formed by
 - (1) transversus aponeurosis
 - (2) post. lamella of int. oblique m.
- ant-wall:
 - (1) ant. lamella of int. oblique
 - (2) ext. oblique aponeurosis

(C) Lower part (below the line midway between umbilicus & s. pubis):

- post-wall: is deficient (formed by fascia transversalis)
- ant-wall: formed by the aponeuroses of the 3 muscles (ext. oblique, int. oblique & transversus abd. which all pass in front of the rectus muscle).

N.B: the aponeurotic post-wall of the rectus sheath ends at the line $\frac{1}{2}$ way between umbilicus & symphysis pubis by forming an arched border called linea semicircularis.

* Contents of the rectus sheath:

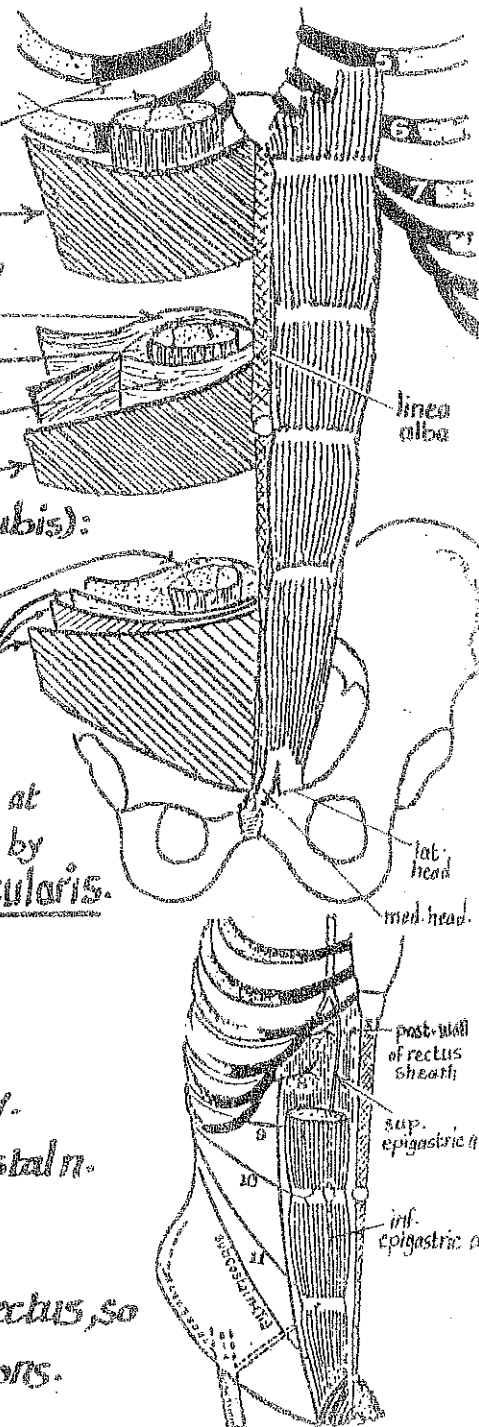
(A) 2 muscles: Rectus abdominis & pyramidalis m.

(b) 4 vessels: sup. epigastric a. & v, inf. epigastric a. & v.

(c) 6 nerves: the lower 5 intercostal nerves & the subcostal n.

* Surgical importance

- (1) the nerves enter the sheath from the lat. side to supply the rectus, so the rectus m. should be retracted laterally in paramedian incisions.



INGUINAL CANAL

Definition: it is an oblique intermuscular passage in the lower part of the ant. abdominal wall transmitting the spermatic cord (in the male) or round lig. of uterus (in the female)

Site: it is situated just above the med. $\frac{1}{2}$ of the inguinal lig.

Length: $1\frac{1}{2}$ inch (4 cm.).

Direction: it is directed downwards, forwards & medially.

Beginning: it begins at the deep inguinal ring which is an oval opening in the fascial transversalis lying $\frac{1}{2}$ an inch above the midinguinal point just lat-to the inf. epigastric a.

End: it ends at the superficial inguinal ring: which is a triangular slit in the external oblique aponeurosis immediately above the pubic tubercle

Boundaries of the Canal:

Ant. wall of the Canal:

Formed of:

- (1) external oblique aponeurosis along its whole length.
- (2) fleshy fibres of origin of int. oblique (along its lat. $\frac{1}{2}$).

Post. wall of the Canal: formed of:

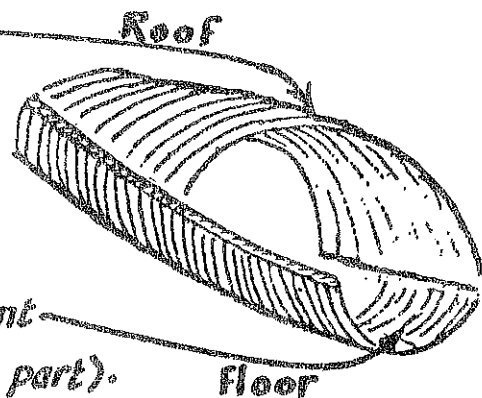
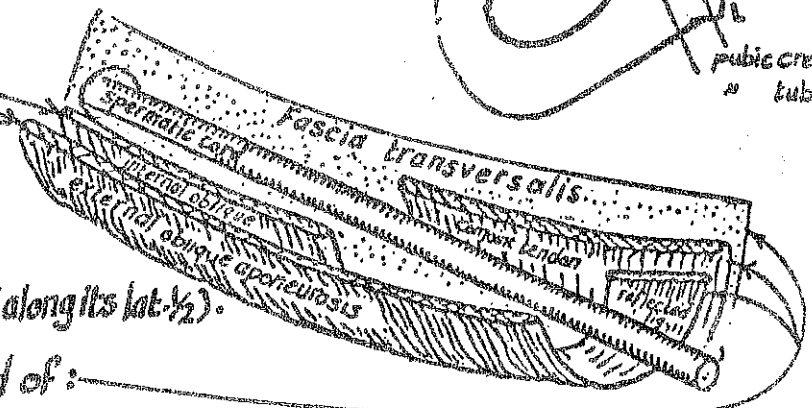
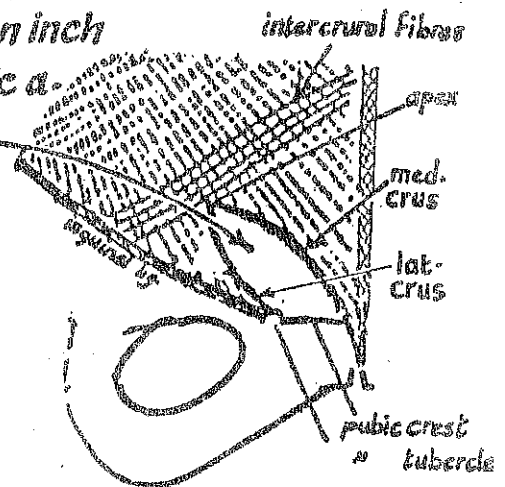
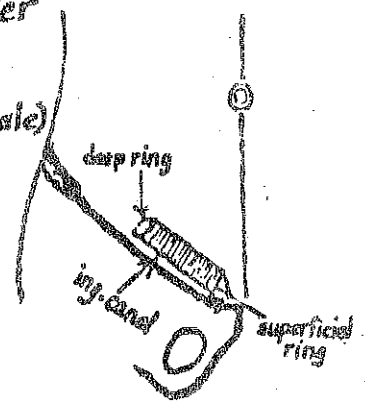
- (1) fascia transversalis : along its whole length.
- (2) conjoint tendon : along its med. $\frac{1}{2}$.
- (3) reflected part. of inguinal lig.: along its med. $\frac{1}{4}$.

Roof of the canal:

formed by the lower arched fibres of the internal oblique muscle.

Floor of the Canal: formed by:

- (1) the grooved upper surface of the inguinal ligament.
- (2) the upper surface of the lacunar lig. (in the med. part).



Boundaries of the Rt. inguinal canal

* **Sex differences**: the inguinal canal is wider in males than in females. **86**

* **Structures passing through the canal**:

(a) in the male: the spermatic cord & its coverings + the ilio inguinal n.

(b) in the female: the round lig. of the uterus + the ilio inguinal n.

N.B: the ilio inguinal n. pierces the post. wall of the canal then passes out through the superficial inguinal ring.

* **Mechanism of the inguinal canal**:

the presence of the inguinal canal represents a weakness in the lower part of the ant. abd. wall. This weakness is compensated by the following mechanisms:

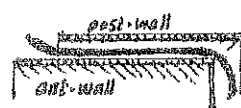
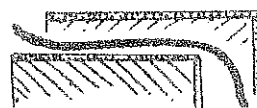
(1) the shutter mechanism of the internal oblique m.

on straining, the lower arched fibres of the int. oblique contract approximating the roof to the floor like a shutter.



(2) the Flop Valve mechanism:

the 2 inguinal rings do not lie opposite each other (due to the obliquity of the canal). Therefore, when the intra abdominal pressure rises the ant. & post. walls of the canal are approximated thus obliterating the passage.



(3) the ball Valve mechanism:

contraction of the cremasteric muscle helps the spermatic cord to plug the superficial inguinal ring.



(4) the Slit Valve mechanism:

contraction of the ext. oblique m. approximates the 2 crura of the superficial ring thus narrowing it to a slit. The intercrural fibres prevent the separation of the 2 crura.

(5) the superficial ring is guarded from behind by the conjoint tendon & the reflected lig.

(6) the deep ring is guarded anteriorly by the fleshy fibres of the int. oblique m.

Inguinal (Haselbach's) Triangle

* **Definition**: it is a triangular area on the inner aspect of the lower part of ant. abd. wall. It may become a site of hernia.

* **Boundaries**:

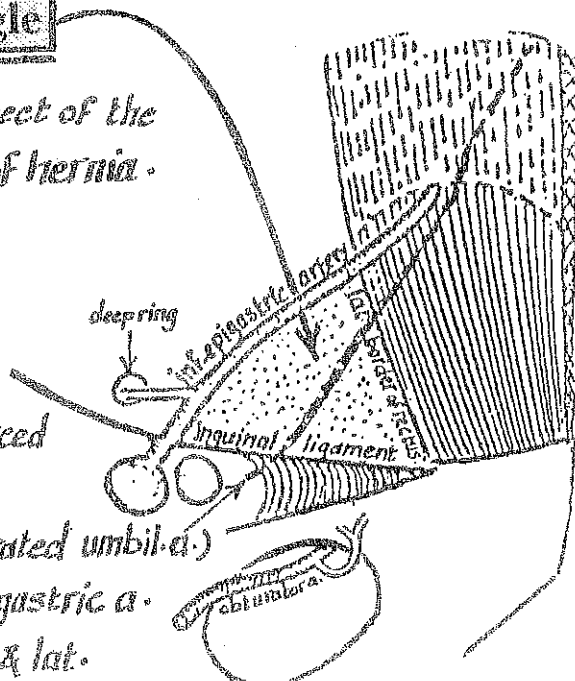
(1) medially: the lat. border of rectus abdominis m.

(2) laterally: the inf. epigastric artery.

(3) inferiorly: the med. $\frac{1}{2}$ of the inguinal ligament.

* **Floor**: formed by fascia transversalis & is reinforced medially by the Conjoint tendon.

* **Subdivisions**: the med. umbilical fold (obliterated umbil. a.) crosses the inguinal Δ med. to the inf. epigastric a. dividing the triangle into 2 parts: med. & lat.



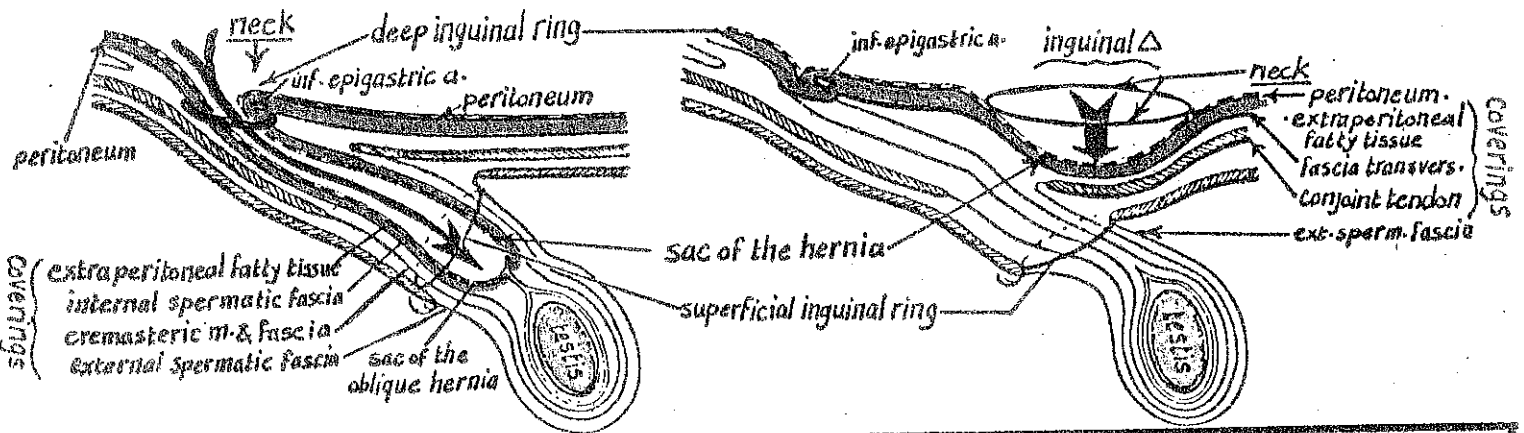


INGUINAL HERNIA

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there are 2 types of hernia occurring in the inguinal region

- oblique (indirect)
- direct



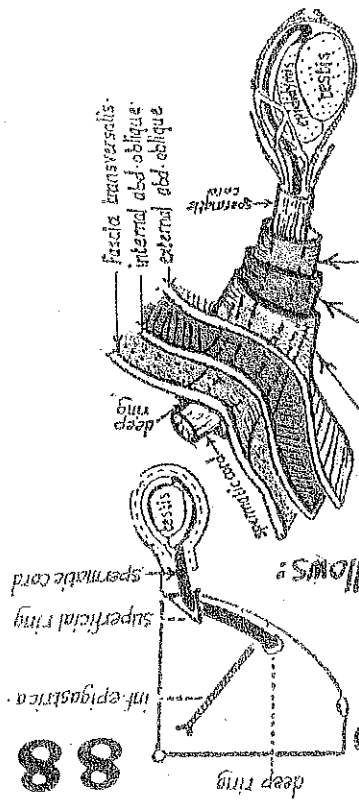
	Oblique (indirect) inguinal hernia	direct inguinal hernia
1- Cause	persistence of processus vaginalis + increased intra-abdominal pressure.	weakness of the ant. abd. wall (mainly the conjoint tendon) + increased intra-abdominal pressure.
2- Incidence	- Commoner in young age. - usually unilateral.	- Commoner in old age } due to diffuse - usually bilateral } fibrosis of the ant abd. wall in old age
3- Neck	lies at the deep inguinal ring just <u>lat.</u> to the inf. epigastric a.	lies at the inguinal triangle (<u>med.</u> to the inf. epigastric a.)
4- Course of the sac	the sac enters the inguinal canal through the deep inguinal ring, passes forwards & medially then comes out through the superficial inguinal ring	the sac pushes the inguinal triangle directly forwards (either med. or lat. to the med. umbilical fold) to enter the med. part of the inguinal canal & may reach the superficial ing. ring.
5- relation to the spermatic cord.	the hernial sac lies <u>in front</u> of the spermatic cord & may reach the scrotum.	the hernial sac lies <u>behind</u> the spermatic cord & does not reach the scrotum.
6- Coverings of the hernial sac	(1) extra-peritoneal fatty tissue. (2) internal spermatic fascia. (3) cremasteric muscle & fascia. (4) External spermatic fascia. (5) superficial fascia & skin.	(1) extra-peritoneal fatty tissue. (2) fascia transversalis (3) cremasteric m. & fascia (if the hernia is lat. to the med. umbilical fold) or conjoint tendon (if the hernia is med. to the fold). (4) external spermatic fascia. (5) superficial fascia & skin.
7- shape	the hernial bulging is piriform (elongated).	the hernial bulging is globular.

Spermatic Cord

* Definition: it is a group of structures (vas deferens, vessels & nerves) dragged by the testis as it descends into the scrotum.

* Site: it extends from the deep ing. ring to the lower end of the testis

* Coverings: it has 3 coverings arranged from outside inwards as follows:



(1) External spermatic fascia: derived from the external oblique aponeurosis at the superficial ring

(2) Cremasteric muscle & fascia: derived from the internal oblique muscle.

(3) Internal spermatic fascia: derived from the fascia transversalis at the deep inguinal ring.

* Contents of the cord:

(1) Vas deferens: a thick-walled muscular duct

(2) pampiniform plexus of veins (forms the main bulk of the cord): it is formed of the veins draining the testis & epididymis which will finally unite to form the testicular v. The Rt. vein opens into I.V.C while the Lt. renal v.

(3) Lymphatic Vessels of the testis: drain into the aortic L.Ns.

(4) 3 Arteries: (a) testicular a.: arises from the abdominal aorta

(b) artery of vas: " inf. vesical a.

(c) cremasteric a.: " inf. epigastric a.

(5) Nerves: (a) cremasteric n.: genital br. of genitofemoral n.

(b) sympathetic fibres.

(6) Vestigial of processus vaginalis: a fibrous cord connecting the peritoneum above with the tunica vaginalis below (it is the obliterated processus vaginalis).

TESTIS

* It is the male sex organ lying in the scrotum (temp. < 37°C).

* It is a mixed gland: exocrine (sperms) & endocrine (testosterone).

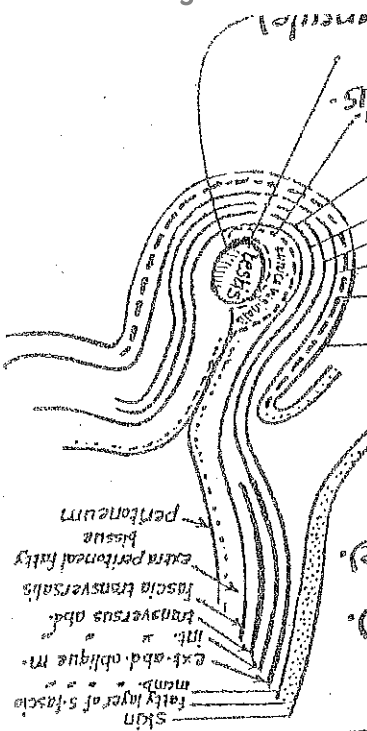
* It is ovoid in shape ($1\frac{1}{2} \times 1 \times \frac{3}{4}$ inches), having 2 surfaces (med. & lat.), 2 borders (ant. & post.) & 2 poles (upper & lower).

* It has 9 coverings: arranged from outside inwards as follows:

(A) 3 cutaneous & subcut.: (1) skin (2) dartos muscle (3) membranous layer of s. fascia

(B) 3 from ant. abd. wall: (4) external spermatic fascia (5) cremasteric muscle & " (6) internal spermatic fascia

(C) 3 special coverings: (7) perietal layer of tunica vaginalis (8) visceral " " " (9) tunica albuginea (thick membrane)



B- ABDOMINAL CAVITY

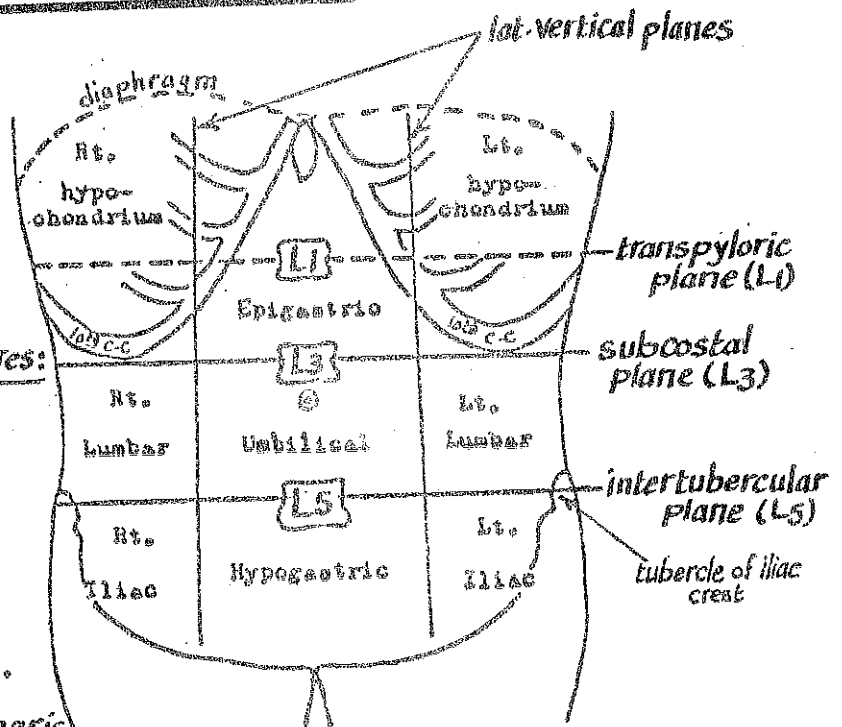
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The planes of the abdomen:

(I) Transpyloric plane:

- * it lies midway between the supra-sternal notch & the symphysis pubis.
- * it passes through the following structures:

- (1) Pylorus of stomach.
- (2) beginning of the duodenum.
- (3) Fundus of the gall bladder.
- (4) the body of the pancreas.
- (5) the origin of the sup. mesenteric a.
- (6) the upper end of the linea semilunaris.
- (7) the body of the 1st lumbar vertebra.
- (8) the tip of the 9th costal cartilage.



(II) Subcostal plane:

- * it is a transverse plane drawn at the level of the lowermost limit of the costal margin.
- * it cuts: (1) the body of the 3rd lumbar vertebra (2) the 10th costal cartilage.

(III) Intertubercular plane:

- * it is a transverse plane passing through the tubercles of the iliac crests.
- * it cuts the body of the 5th lumbar vertebra.

(IV) Lateral Vertical planes (Rt. & Lt.):

2 vertical planes drawn from the midinguinal points below to the midclavicular points above.

Regions of the abdomen

- * the abdomen is divided, for descriptive purposes into 9 regions by 4 planes:
 - 2 horizontal planes: the subcostal plane & the intertubercular plane.
 - 2 vertical planes: the Rt. & Lt. lat. vertical planes.

* the 9 abdominal regions are:

(1) Rt. hypochondrium	(2) epigastrium	(3) Lt. hypochondrium
(4) Rt. lumbar	(5) umbilical	(6) Lt. lumbar
(7) Rt. iliac	(8) hypogastrum	(9) Lt. iliac

GASTRO INTESTINAL TRACT

1. STOMACH

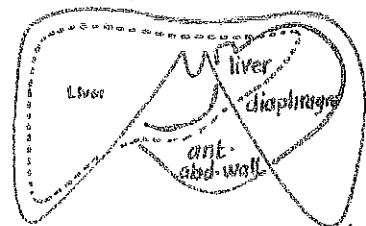
90

* Site: in the Lt. hypochondrium, epigastrium & umbilical regions.

* Shape: (1) J-shaped (vertical): the commonest type
(2) steer-horn (horizontal): less common
it has 2 orifices, 2 borders & 2 surfaces

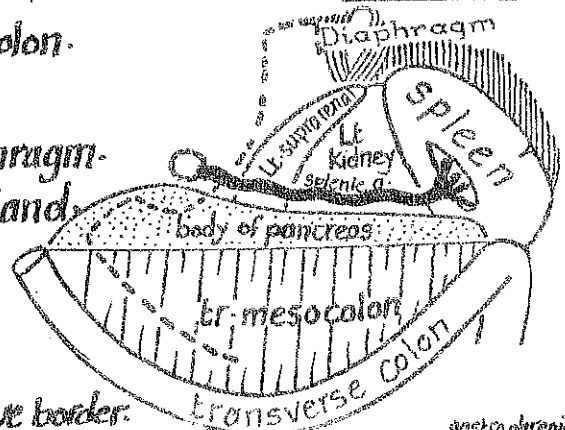
* Orifices: (1) Cardiac orifice: at the junction with the oesophagus
It lies opposite the Lt. 7th costal cartilage 1" to the Lt. of midline & 4.5 cm. from incisor teeth. It has no true anatomical sphincter.
(2) Pyloric orifice: at the junction with the duodenum
It lies at the level of L1 (transpyloric plane) 1/2" to the Rt. of midline. It has a true anatomical sphincter which is identified at operation by:
(a) feeling its thickness (b) annular groove (c) pre pyloric v. of Mayo in front of it.

* Surfaces: (a) Antero-superior surface: related to:
(1) Lt. lobe of liver.
(2) diaphragm.
(3) ant. abdominal wall.



(b) Postero-inferior surface: related to the structures forming the Stomach bed:

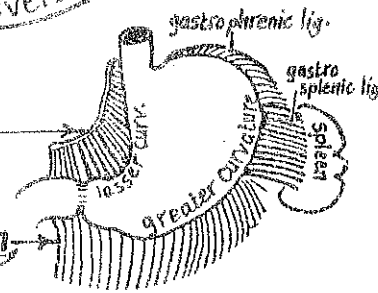
- (1) transverse colon. (2) transverse mesocolon.
- (3) body of pancreas. (4) splenic artery.
- (5) spleen. (6) Lt. crus of diaphragm.
- (7) Lt. kidney. (8) Lt. suprarenal gland.



N.B: the lesser sac intervenes between the stomach & its bed.

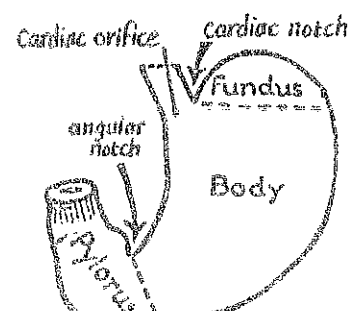
* Borders:

- (1) Lesser curvature: it is the Rt. concave border.
presents angular notch
gives attachment to lesser omentum
- (2) Greater curvature: it is the Lt. convex border.
gives attachment to greater omentum & gastro splenic ligament.



* Parts of the stomach:

- (1) Fundus: above the level of the cardiac orifice.
- (2) Body: extends from the level of the Cardiac orifice to an imaginary line between the angular notch to a corresponding bulge on the greater curvature.

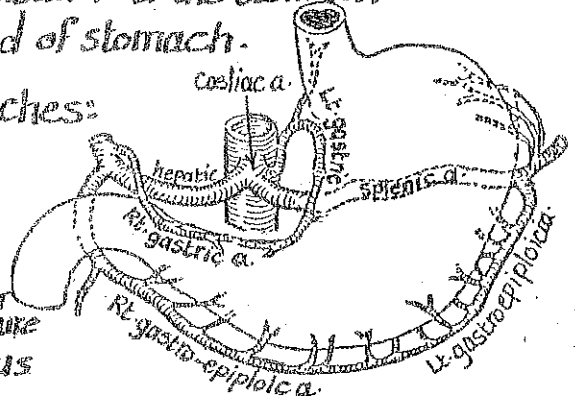


(3) pyloric portion : distal to the imaginary line & consists of 3 parts :

- (a) pyloric antrum : the dilated part below the body.
- (b) » Canal : the narrow distal 1" of the stomach.
- (c) » sphincter : » distal end of stomach.

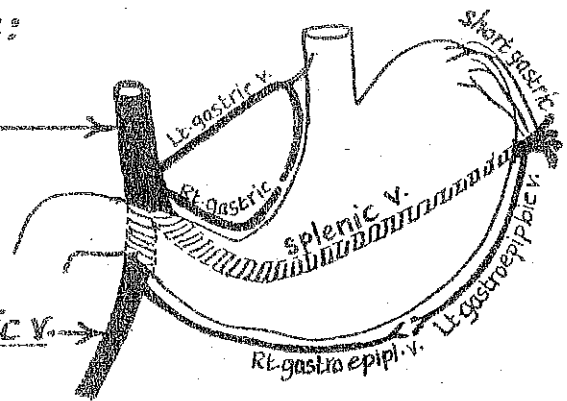
* Arterial Supply : by coeliac trunk & its branches:

- (1) Lt. gastric a. : From coeliac trunk } along lesser curvature
- (2) Rt. gastric a. : br. from hepatic a. } along lesser curvature
- (3) Rt. gastro epiploic a. : br. of gastroduodenal } along greater curvature
- (4) Lt. gastro epiploic a. : br of splenic artery } along greater curvature
- (5) short gastric arteries (from splenic a) to the fundus



* Venous drainage : into portal v. & its tributaries:

- (1) Lt. gastric v. } drain into portal v.
- (2) Rt. gastric v. }
- (3) Lt. gastro epiploic v. } drain into splenic v.
- (4) short gastric vv. }
- (5) Rt. gastro epiploic v. : drain into sup. mesenteric v.

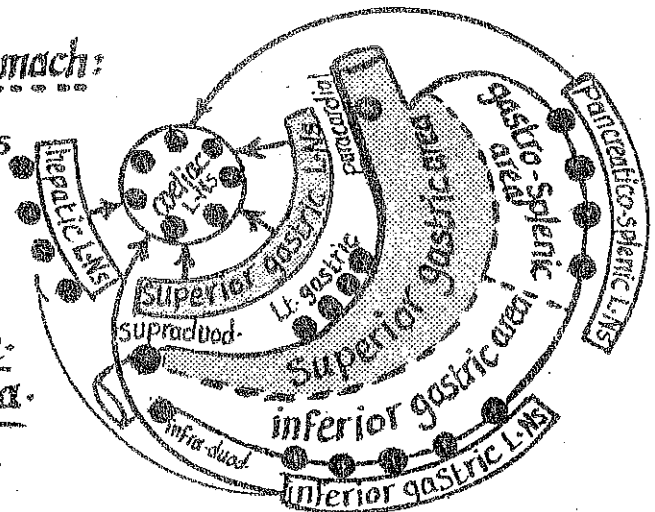


* Lymphatic drainage :

(A) Lymphatic territories (areas) of the stomach:

an imaginary line along the longitudinal axis of the stomach divides it into :

- Rt. 2/3 : superior gastric area
- Lt. 1/3 : which is further subdivided into:
 - (a) upper 1/3 : gastro splenic area.
 - (b) lower 2/3 : inferior gastric area.



(B) Lymph nodes draining the stomach :

the draining L.Ns are arranged in chains along the greater & lesser curvatures in relation to the major vessels & include the following groups.

Lymph node groups	area drained by it	efferent lymphatics pass to:
1- <u>Sup. gastric L.Ns</u> which include: (a) paracardiac group around cardiac orifice (b) Lt. gastric group along Lt. gastric a. (c) Supra pyloric group above pylorus	Sup. gastric area.	Coeliac L.Ns.
2- <u>Inf. gastric L.Ns</u> : along Rt. gastro epiploic a.	Inf. gastric area.	Coeliac L.Ns, few pass to the hepatic L.Ns.
3- <u>pancreatico-splenic L.Ns</u> : in the gastrosplenic lig.	gastro-splenic area.	Coeliac L.Ns.

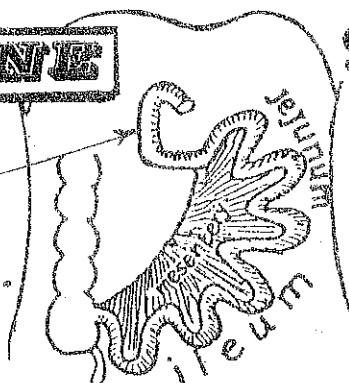
2. SMALL INTESTINE

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* Subdivisions:

- (1) Duodenum: the 1st 10" & the only fixed part
- (2) Jejunum: the proximal 2/5 (8 feet) of small intestine.
- (3) Ileum: the distal 3/5 (12 feet) of small intestine

N.B: both jejunum & ileum are mobile & have mesentery attached to the post-abd. wall.



Duodenum

* It is the shortest, widest & most fixed part of the small intestine

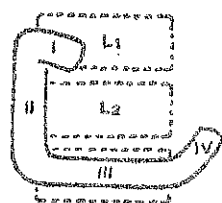
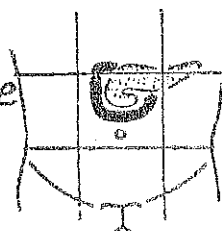
* Site: mainly in the umbilical region against L1, L2 & L3 vertebrae.

* Shape: C-shaped loop surrounding the head of pancreas.

* Length & parts: it is 10 inches long & is divided into 4 parts:

- (1) First (superior) part: 2" long
- (2) Second (descending) part: 3"
- (3) Third (horizontal) part: 4"
- (4) Fourth (ascending) part: 1"

* peritoneal relations: it is mostly retroperitoneal & fixed except at the beginning & the end which are suspended & mobile.



* FIRST PART OF DUODENUM

* Begins: as a continuation of the pylorus, 1/2" to the Rt. of middle line at the level of L1

* Course: passes upwards, backwards & to the Rt. under cover of quadrate lobe of liver.

* Ends: close to the neck of gall bladder by curving downwards to become the 2nd part.

* Relations:

I - Anteriorly:

- (1) quadrate lobe of liver
- (2) neck of gall bladder

II - Superiorly:

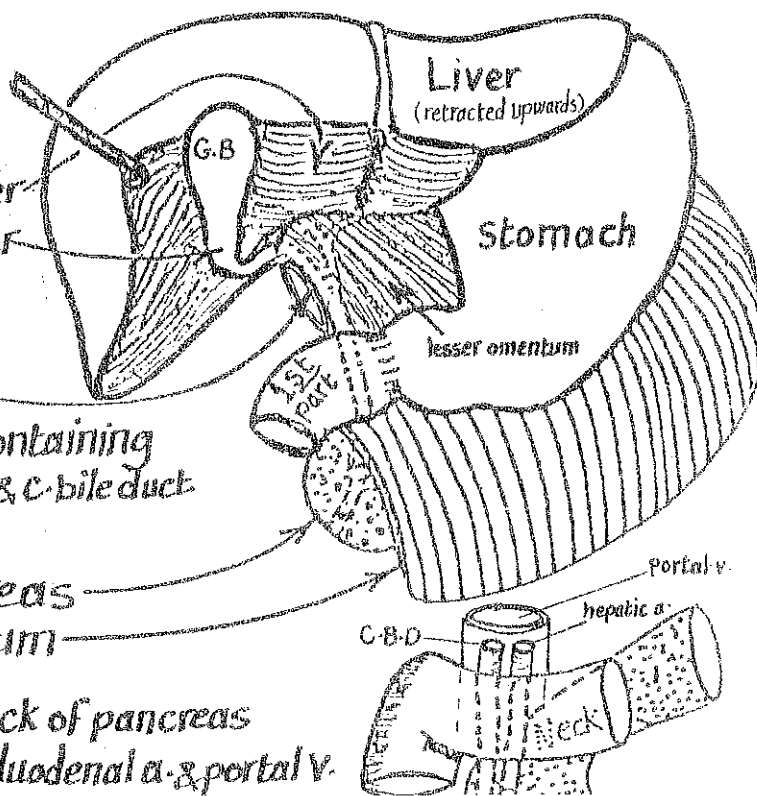
- (1) epiploic foramen
- (2) lesser omentum containing portal v., hepatic a. & c. bile duct

III - Inferiorly:

- (1) head of pancreas
- (2) greater omentum

IV - posteriorly: (1) neck of pancreas

- (2) C-B duct, gastroduodenal a. & portal v.

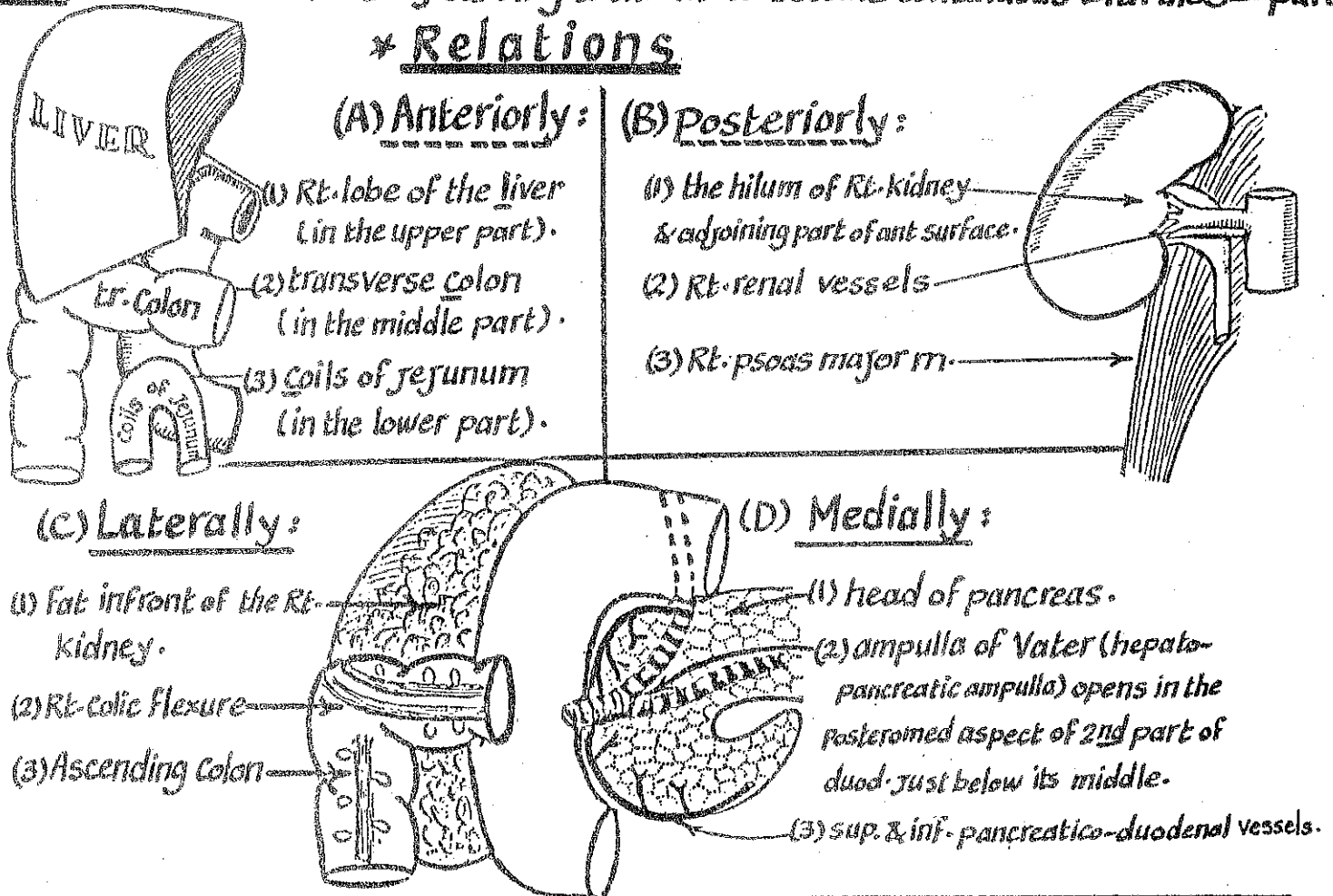


SECOND PART OF DUODENUM

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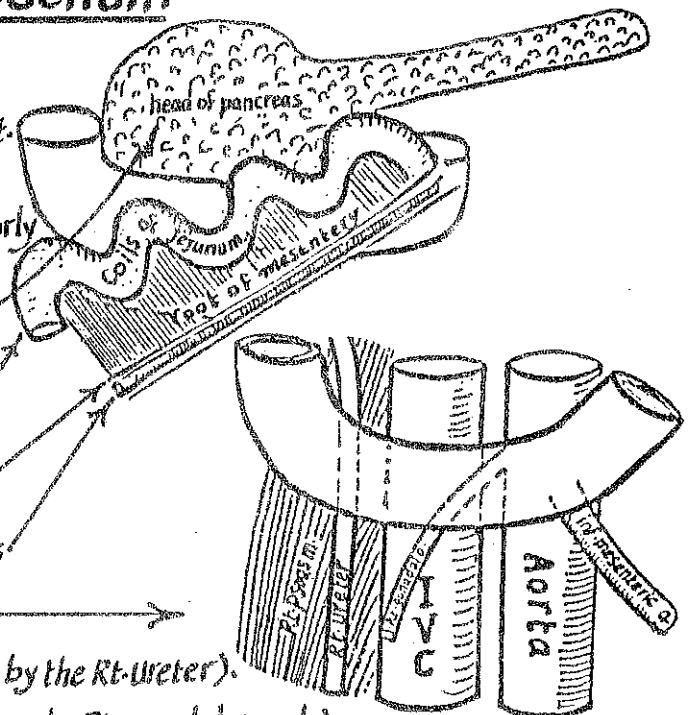
- * Begins : at the level of L1 as a continuation of the 1st part.
- * Course : descends vertically in front of the hilum of the Rt. kidney.
- * Ends : at the level of L3 by curving to the Lt. to become continuous with the 3rd part.

* Relations



3rd Part of duodenum

- * Length : it is the longest part (4" long).
- * Course : it passes horizontally from Rt. to Lt. at the level of L3 vertebra.
- * peritoneum : it is covered by peritoneum anteriorly and inferiorly.
- * Relations :
 - A- superiorly : head of pancreas
 - B- inferiorly : coils of jejunum.
 - C- Anteriorly :
 - (1) coils of jejunum
 - (2) root of mesentery
 - (3) sup. mesenteric vessels.
 - D- Posteriorly (from right to left) :
 - (1) Rt. psoas major m. (separated from duodenum by the Rt. ureter).
 - (2) inferior vena cava: (" " " " the Rt. gonadal vessels).
 - (3) abdominal aorta: (" " " " the inf. mesenteric artery).



4th part of duodenum

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- * Length: it is the shortest part of the duodenum (one inch long).
- * Course: it ascends along the Lt. side of the vertebral column (from L3 to L2).
- * peritoneum: it is covered by peritoneum anteriorly & to the left.

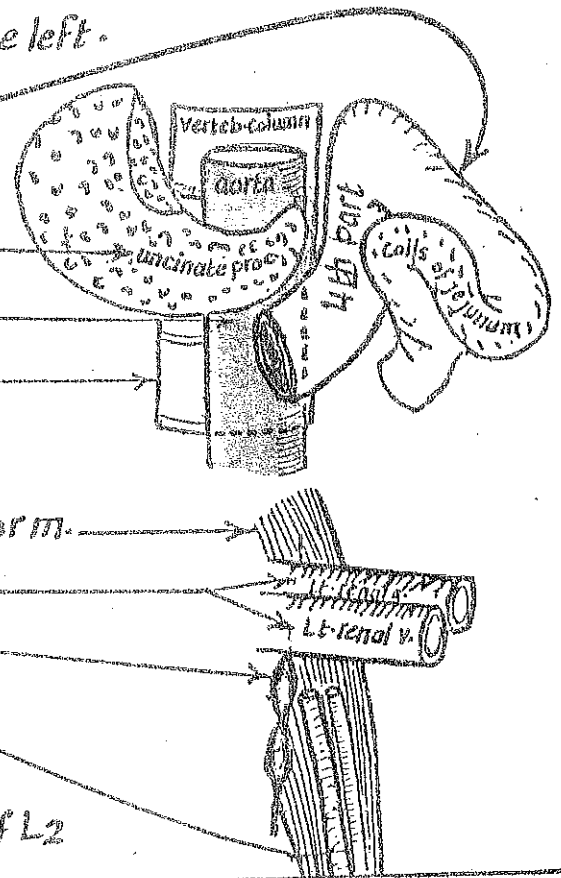
* Relations:

- (a) anterolaterally: Coils of jejunum.
- (b) medially (to the Rt.): (1) uncinete process of pancreas
- (2) abdominal aorta
- (3) vertebral column

(c) posterior relations:

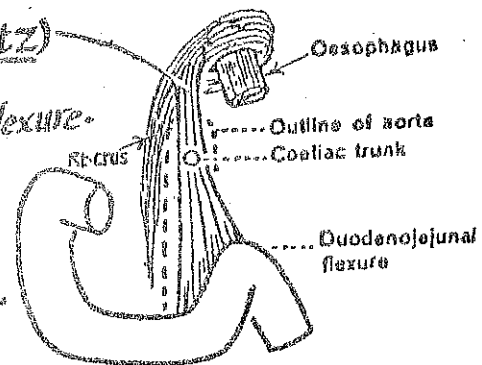
- (1) med. border of Lt. psoas major m.
- (2) Lt. renal vessels
- (3) Lt. sympathetic chain
- (4) Lt. gonadal vessels

- * Termination: it ends by curving forwards to form the duodeno-jejunal flexure on the Lt. side of L2



Suspensory muscle of duodenum (Lig. of Treitz)

- * it is a fibromuscular band which suspends the duodenojejunal flexure.
- * it arises from the Rt. crus of diaphragm close to the oesophagus
- * it descends behind the pancreas to be attached to the post. aspect of the duodenojejunal flexure & the 3rd & 4th parts of duod.

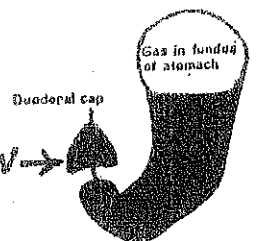


* Arterial supply of duodenum:

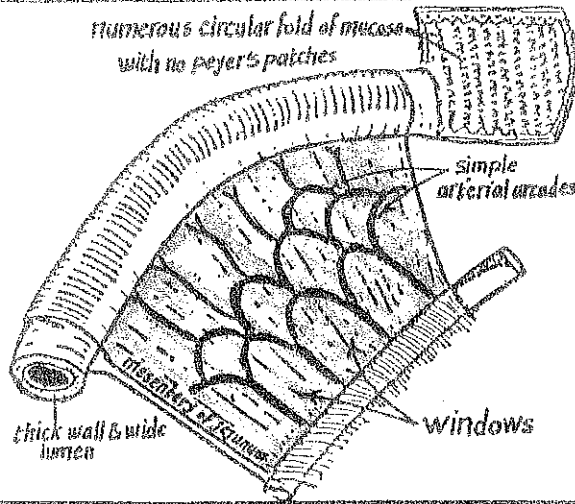
- (1) sup. pancreatico duodenal a. (br. of gastroduodenal a.)
 - (2) inf. " " " (br. of sup. mesenteric a.)
 - (3) supraduodenal a. (br. of hepatic a.)
- } both arteries run in the curved groove between the duod. & head of pancreas & anastomose together.

* SURGICAL IMPORTANCE:

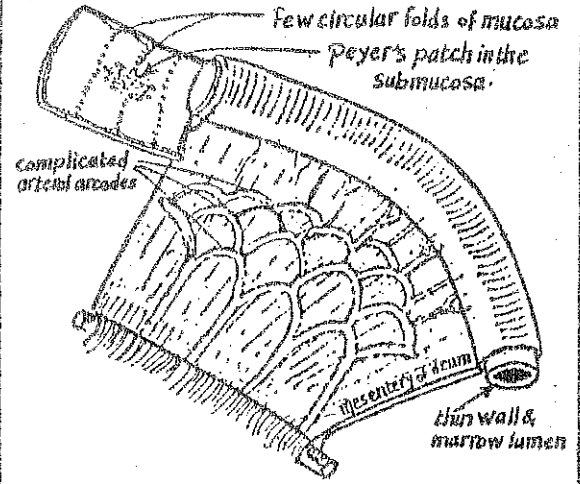
- Radiologically, the 1st part of duodenum is seen as triangular shadow → (barium meal study).
- duodenal ulcer usually affects the 1st part → distortion of the duodenal cap.
- Cancer head of pancreas produces widening of duodenal loop radiologically.
- obstruction of the 3rd part of duodenum may be caused by pressure by sup. mesenteric a.
- " " " " " " " " by contraction of susp. lig. of duod.



Jejunum



Ileum



(1) Length	* Constitute the proximal 2/5 of small intestine. * about 8 feet long.	constitutes the distal 3/5 of small intestine. * about 12 feet long.
(2) Location	tends to lie more in the umbilical region	* tends to lie more in the hypogastrium.
(3) Lumen	wider than ileum.	* narrower than jejunum.
(4) Wall	* Wall: thicker, having thicker mucosa (due to active absorption) & thicker musculosa (due to active peristalsis).	* thin wall (having thinner mucosa and musculosa) because digestion & absorption are less active in the ileum than jejunum.
(5) Mucosal Folds	* Circular folds of the mucosa are more numerous.	* the mucosa contains few circular folds.
(6) Peyer's Patches	* Peyer's patches (aggregation of lymphoid follicles in the submucosa): are absent	* many Peyer's patches in the submucosa along the antimesenteric border of ileum.
(7) Arteries	* the jejunal arteries anastomose together forming one or 2 arches (simple arterial arcades) in the mesentery of the jejunum.	* the ileal arteries form 3 or 4 or even 5 arches in the mesentery of ileum (complicated arterial arcades).
(8) Mesentery	* the jejunal mesentery contains less fat allowing light to pass in the spaces between arteries (windows of mesentery).	* the mesentery of ileum contains dense fat which masks the arteries (no windows).
(9) Identification	* At operation, the jejunal wall is felt as double layer	* At operation the ileal wall is felt as single layer.

* Mesentery of the Small intestine :

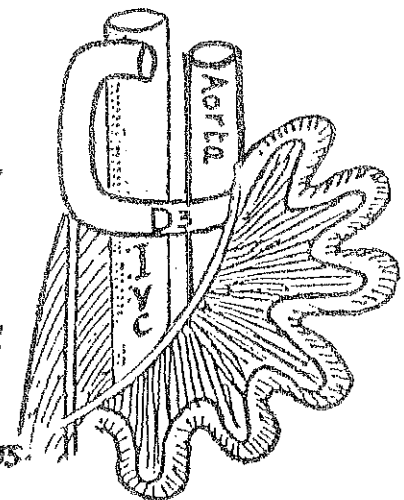
— it is a fan-shaped peritoneal fold having :

(A) Free border : 6 meters long & encloses the jejunum & ileum.

(B) Attached border 6 inches long & is attached to the post. abd. wall crossing 6 structures :

- (1) 4th part of duodenum (2) 3rd part of duod. (3) aorta
- (4) I.V.C. (5) Rt. psoas major m. (6) Rt. ureter

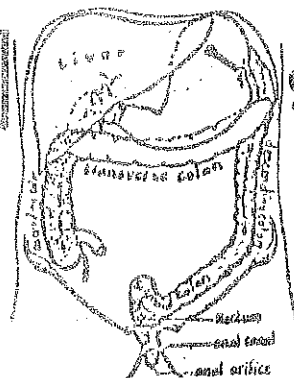
— Contents : (1) coils of jejunum & ileum (2) sup. mesenteric a. & its b. (3) sup. mesent. v. & its tributaries (4) lymphatics & L.Ns



3. LARGE INTESTINE

* parts :

- (1) Caecum (2) ascending colon (3) Rt. colic flexure
- (4) tr. colon (5) Lt. colic flexure (6) descending colon
- (7) pelvic colon (8) rectum (9) anal canal



* Differences between large intestine & small intestine:

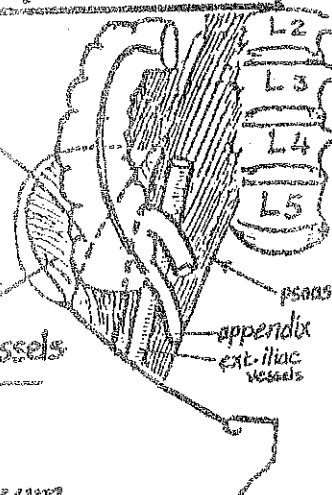
Feature	Small intestine	Large intestine
Length	6 meters	1½ meters
Mobility	it is mobile except the duodenum which is fixed	it is fixed except the tr. colon & pelvic colon which are mobile
Diameter	has a smaller diameter	has a larger diameter
Taenia coli	Absent	present
Sacculations	Absent	present
Appendices epiploicae	Absent	present
effect of irritation	Diarrhoea	Dysentery

CAECUM

* Site : in the Rt. iliac fossa above the lat. ½ of the inguinal lig.

* Relations : anteriorly : ant. abd. wall, greater omentum, loops of intestine.

posteriorly : retrocaecal recess, Rt. psoas major & iliacus femoral n., lat. cut. n. of thigh, Rt. gonadal & ext. iliac vessels



VERMIFORM APPENDIX

* Site : Rt. iliac fossa, attached to the posteromed. aspect of caecum 2 cm. below the ileocaecal valve.

* Size : 2-20 cm long (average 10 cm) & about ½ cm wide (the narrowest part of gut).

N.B. : it is wide in infants & fibrosed in old age (appendicitis is rare).

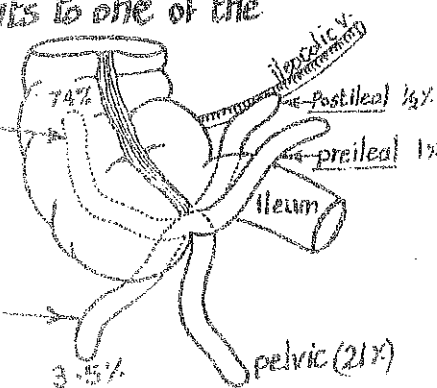
* Position : though the base of the appendix is fixed, its tip points to one of the following positions :

(1) retrocaecal (74%) : behind the caecum (in the retrocaecal recess)

(2) pelvic (21%) : the appendix hangs over the pelvic brim where it is related to ext. iliac vessels, ovary & uterine tube.

(3) subcaecal (3.5%) : the appendix lies below the caecum.

(4) pre-ileal (1%) : in front of the terminal part of the ileum.



(5) post-ileal position ($\frac{1}{2}\%$): the appendix lies behind the terminal part of ileum, in contact with the ileocolic v. It is the most dangerous position because spread of infection to the vein may lead to portal pyaemia.

* Surface anatomy of the base of appendix (McBurney's point)

it is a point at the junction of the lat. $\frac{1}{3}$ & med. $\frac{2}{3}$ of a line extending from the A-S-I-S to the umbilicus (spino-umbilical line).

* Peritoneal covering of the appendix:

It is completely covered with peritoneum & is suspended to the back of the mesentery of terminal ileum by a triangular fold of peritoneum called mesoappendix.

* Arterial Supply: appendicular artery (br. of ileo-colic a.):

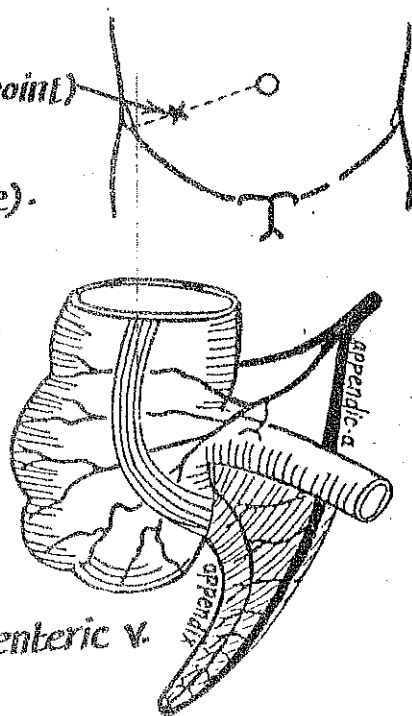
it runs in the free border of the mesoappendix towards the tip.

* Venous drainage: appendicular v. $\rightarrow$ ileocolic v. $\rightarrow$ sup. mesenteric v. $\rightarrow$ portal v.

* Nerve Supply: T10 supplies the peritoneal covering of the appendix. Referred pain of the appendix is felt at the umbilicus which has the same n-supply.

* Microscopically, the submucosa of the appendix is rich in lymphoid tissue.

* Identification of appendix at operation: the 3 taenia coli converge towards the base of the appendix to form a continuous coat in its wall.



RECTUM

* Site: post. part of pelvic cavity, in front of lower $\frac{1}{2}$ of the sacrum

* Size: it is 5" long. Its upper part is $1\frac{1}{2}$ " in diameter while its lower part is dilated to form the rectal ampulla ($2\frac{1}{2}$ " in diameter).

* Extent:

- It begins opposite the 3rd sacral piece as a continuation of sigmoid colon.

- It ends 1" below & in front of the tip of coccyx by bending sharply backwards & downwards to form the anal canal.

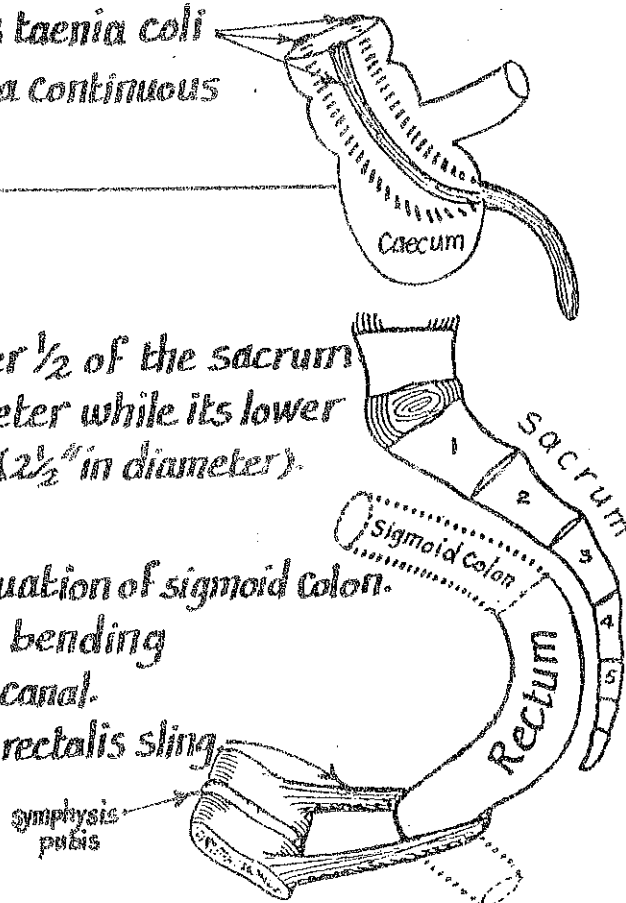
The ano-rectal junction is surrounded by the puborectalis sling.

* Curvatures:

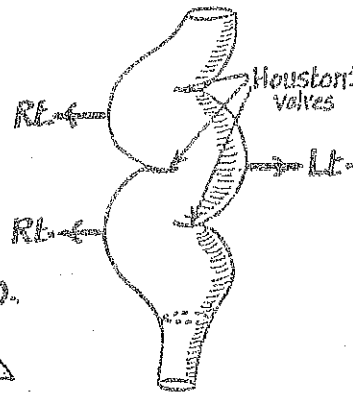
(A) Anteroposterior Flexures: 2

(1) Sacral Flexure concave forwards (following the concavity of the sacrum).

(2) Perineal Flexure: convex forwards at the anorectal junction.



- (B) Lateral flexures : 3
- (1) upper : convex to the Rt. side.
 - (2) middle : " " " Lt. side.
 - (3) lower : " " " Rt. side.



* Mucosal folds (Houston's valves) :

the mucous membrane shows 3 transverse folds at the concave sides of the 3 lat. flexures (i.e upper Lt, middle Rt & lower Lt. fold).

* peritoneal covering of rectum :

- (1) its upper $\frac{1}{3}$: is covered on the front & sides.
- (2) its middle $\frac{1}{3}$: is covered on the front only.
- (3) its lower $\frac{1}{3}$: has no peritoneal covering.



* Relations of the rectum :

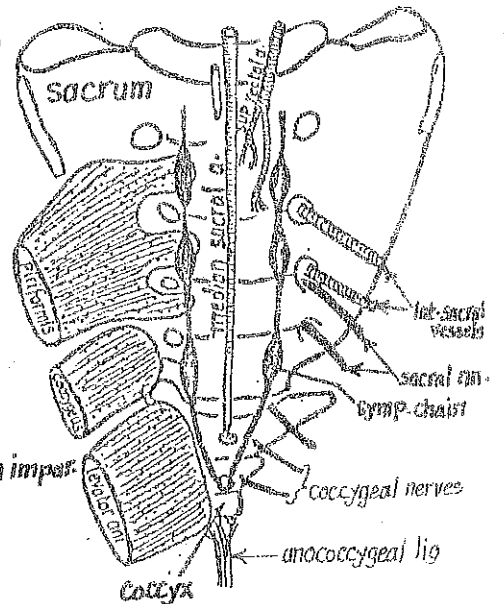
I- posterior relations (Common in ♂ & ♀) :

- (A) Bones & Ligaments : 3
- (1) lower $\frac{1}{2}$ of sacrum.
 - (2) Coccyx.
 - (3) ano-coccygeal lig.

- (B) Muscles (of both sides) : 3
- (1) piriformis
 - (2) Coccygeus
 - (3) levator ani

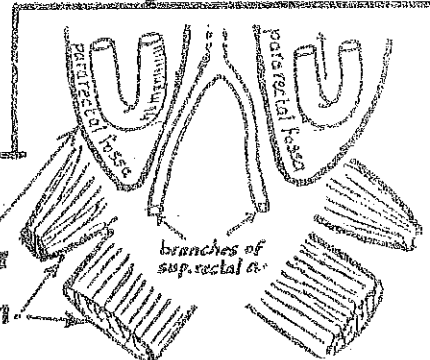
- (C) Nerves " " " : 3
- (1) 2 sympathetic chains & ganglion impar.
 - (2) lower 3 sacral nerves.
 - (3) Coccygea nerves

- (D) Vessels : 3
- (1) superior rectal vessels.
 - (2) median sacral "
 - (3) lateral sacral "



II- Lateral relations (Common in ♂ & ♀) : —

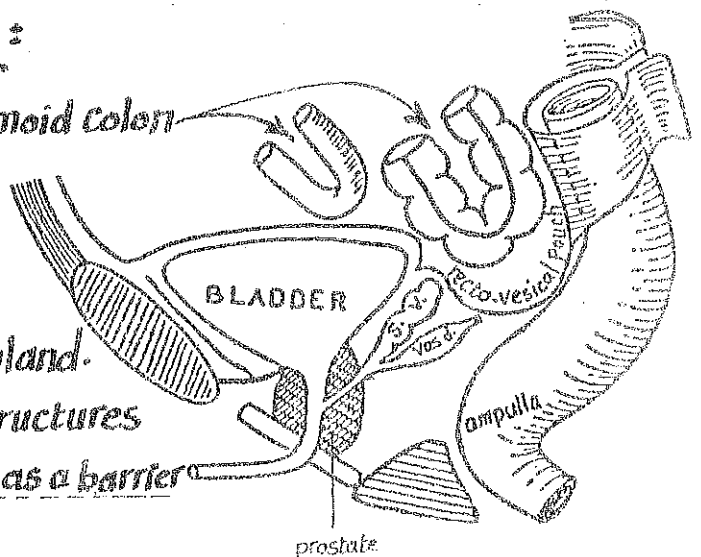
- (1) upper part : loops of small intestine in the pararectal fossa
- (2) lower part : brs. of sup. rectal a., coccygeus & levator ani mm.



III- Anterior relations in the male :

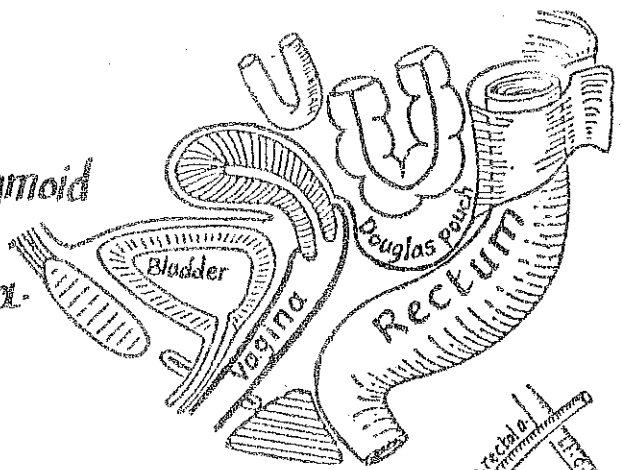
- (1) upper $\frac{2}{3}$: related to coils of ileum & sigmoid colon (in the recto-vesical pouch).
- (2) lower $\frac{1}{3}$: related to base of urinary bladder, 2 seminal vesicles, 2 vasa deferentia & prostate gland.

N.B : the rectum is separated from these structures by the dense Denonvillies fascia (acts as a barrier against the spread of cancer).



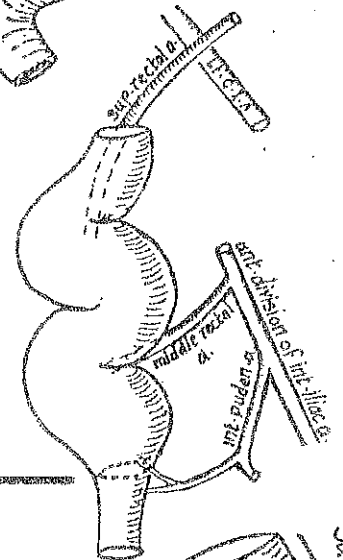
* Anterior relation in the female:

- (1) upper 2/3 : related to coils of ileum & sigmoid colon (in the Douglas pouch)
- (2) lower 1/3 : related to post-wall of vagina.



* Arterial Supply of rectum:

- (1) sup. rectal a. (continuation of the inf. mesenteric a.).
- (2) middle rectal a. (br. of ant. division of internal iliac a.).
- (3) inferior rectal a. (br. of internal pudendal a.).



* Venous drainage : the veins follow the arteries :

- the sup. & middle rectal veins drain into the portal circulation.
- the inferior rectal v. drains into the systemic circulation.

ANAL CANAL

* Begins : 1" below & in front of coccyx as a continuation of the rectum.

* Direction : passes downwards & backwards.

* Ends : at the anal orifice.

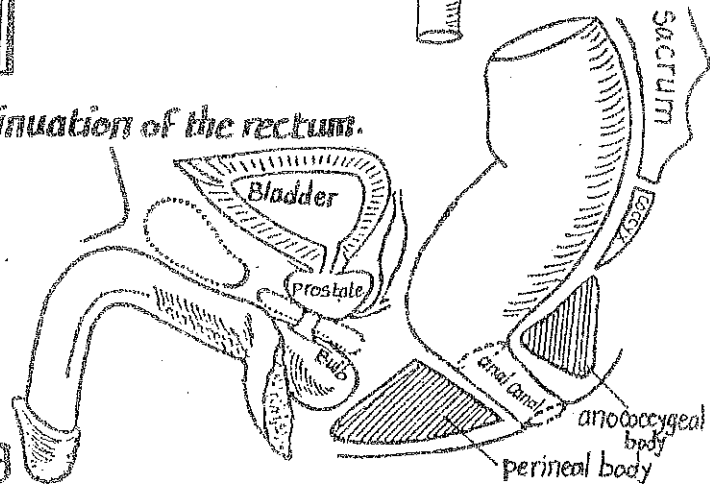
* Length : $1\frac{1}{2}$ " (4 cm).

* Relations :

(A) Anteriorly : perineal Body separating the anal canal from the bulb of penis in the σ^7 & the vagina in the f

(B) Posteriorly : anococcygeal Body separating the canal from tip of coccyx

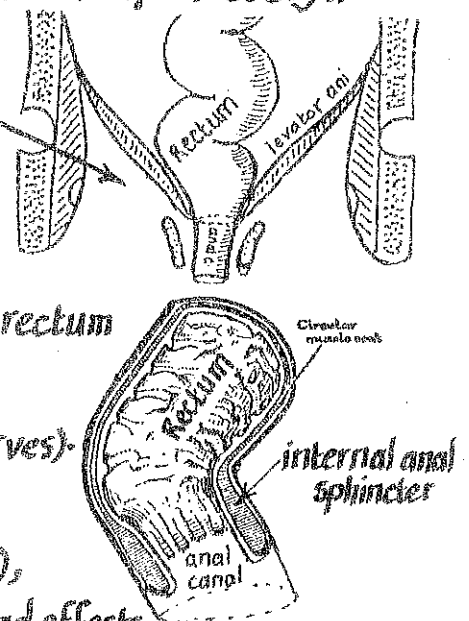
(C) on each side : ischiorectal Fossa containing fat.



* Sphincters of the anal canal :

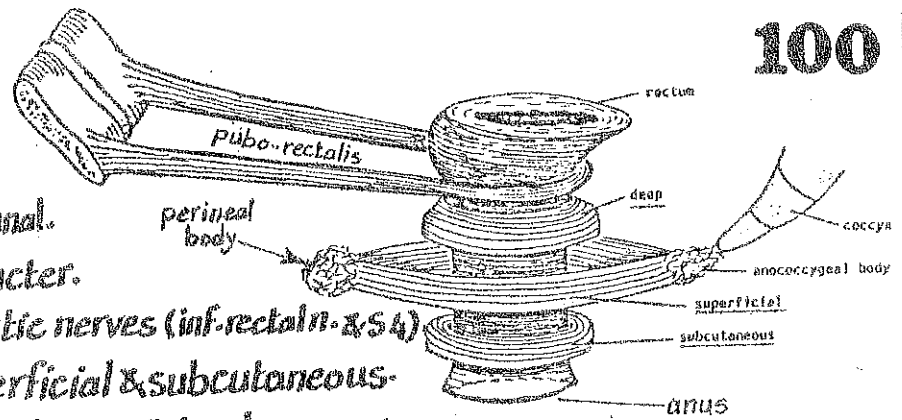
(A) Internal anal sphincter :

- it is the continuation of the circular muscle layer of the rectum
- it surrounds the upper 3/4 of the anal canal.
- it is an involuntary sphincter (supplied by autonomic nerves).
- Surgical importance : it shows spasm in any painful anal condition (e.g. anal fissure). Its division (sphincterotomy), removes the spasm & pain and improves drainage without bad effects.



(B) External anal sphincter:

- Formed of striated muscle fibres.
- Surrounds the whole length of anal canal.
- lies outside the internal anal sphincter.
- it is voluntary & supplied by somatic nerves (inf. rectal n. & S4)
- Consists of 3 parts: deep, superficial & subcutaneous.
- Surgical importance: complete division of the deep part produces incontinence.



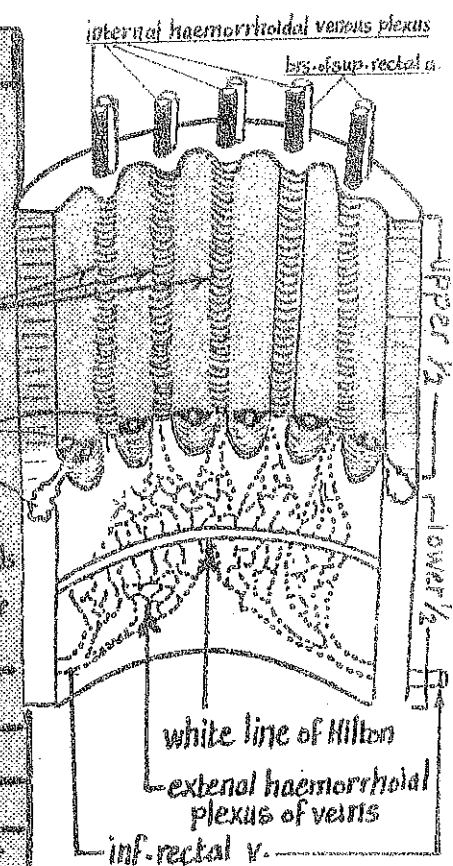
(C) Ano-rectal ring:

- It is a muscular ring at the junction of the rectum & anal canal.
- It is formed by the fusion of 4 muscular structures: (1) pubo-rectalis part of levator ani (2) deep part of ext. anal sphincter (3) the longitudinal muscle layer (4) the internal anal sphincter.
- On P.R exam the ring is felt as a ridge (more marked posteriorly & laterally).
- damage to this ring results in rectal incontinence (it must be protected during the removal of the fistulous tracks).

Cavity of the anal Canal

- * The cavity of the anal canal is divided into 2 halves (upper $\frac{1}{2}$ & lower $\frac{1}{2}$) by a line called Pectinate line where the mucous memb. shows crescentic folds called anal valves.

	lower $\frac{1}{2}$	upper $\frac{1}{2}$
Embr. origin	ectodermal (from the proctodeum).	endodermal (from the cloaca).
site	below the pectinate line	above the pectinate line.
lining & features of the m. memb.	- its upper part: is transitional & lined by stratified squamous epith. with dense submucosa. - its lower part: is lined by true skin (containing sweat & sebaceous glands) - the white line of Hilton separates the 2 parts. It demarkates the lower end of the internal anal sphincter.	- lined by simple squamous epith. & shows the following features: (1) Anal Columns of Morgagni: 6-10 longitudinal folds, each of which lodges a branch of sup. rectal a. & v. (2) anal sinuses: small recesses through which open the anal glands & lie deep to the anal valves. (3) anal Valves of Ball: crescentic folds of m. memb. connecting the lower ends of the columns & lie at the pectinate line
Arterial supply	middle & inf. rectal arteries.	sup. rectal artery.
Venous drainage	middle & inf. rectal veins (systemic).	superior rectal vein (portal).
Lymph drainage	to superficial inguinal L.N.s.	to internal iliac L.N.s.
Nerve supply	inf. rectal n. (somatic, sensitive to pain)	by autonomic nerves (insensitive).



4. **SPLEEN**

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Size : 1 x 3 x 5 inches. **Weight** : 7 ounces (200 gms)

Site : Lt. hypochondrium opposite the ribs 9, 10, 11 with its long axis parallel to the 10th rib.

Shape : has the shape of a cupped hand.

It has ———— 2 ends : med. (post.) & lat. (ant.).
 ———— 2 borders : upper & lower.
 ———— 2 Surfaces : diaphragmatic & visceral.

The medial (post.) end : is tapering and directed upwards, backwards & medially. It lies $1\frac{1}{2}$ inches from the median plane.

The lateral (ant.) end : is broad and directed downwards, forwards & laterally. It does not extend beyond the midaxillary line.

the upper border : is sharp & presents a notch near its ant. end.

the lower border : is rounded & smooth.

the Diaphragmatic surface : smooth, convex & is related to the diaphragm which separates the spleen from : Lt. lung & pleura & the ribs 9, 10 & 11

the Visceral Surface : Concave, presents the hilum & 4 impressions:

(1) **Gastric impression** : between the hilum & the upper border.
 It is related to the fundus of stomach.

(2) **Renal impression** : between the hilum & the lower border.
 It is related to the front of the Lt. kidney.

(3) **Pancreatic impression** : just below the lat. end of the hilum.
 It is related to the tail of pancreas.

(4) **Colic impression** : close to the lat. end of the spleen.
 It is related to the Lt. colic flexure

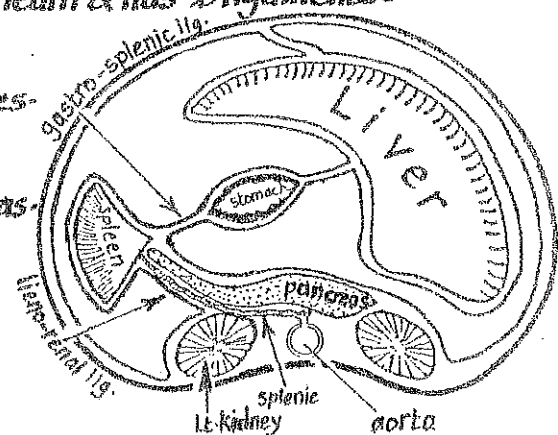
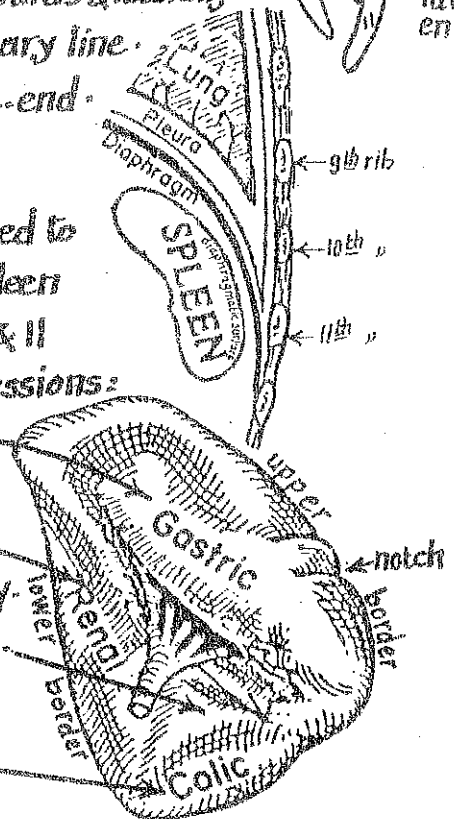
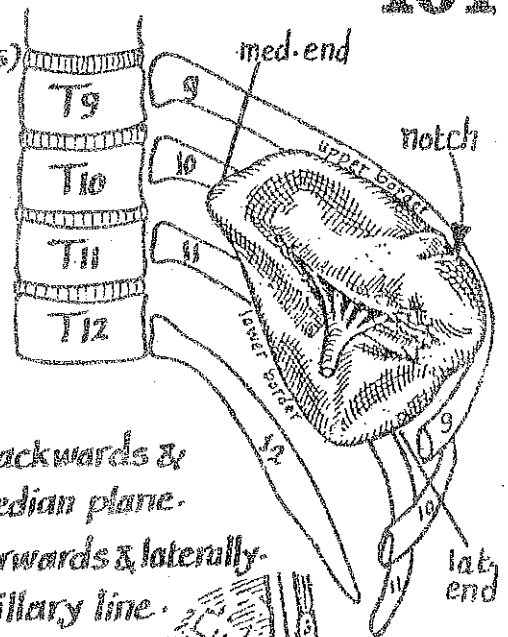
Peritoneal relations : it is completely covered by peritoneum & has 2 ligaments:

(1) **gastrosplenic lig.** : between stomach & hilum of spleen.
 it carries Lt. gastroepiploic & short gastric ves.
 (2) **lienorenal lig.** : between Lt. kidney & hilum of spleen
 it contains the splenic vessels & tail of pancreas.

N.B : the phrenico-colic lig. which extends between the Lt. colic flexure & the diaphragm supports the spleen from below. It directs the enlarged spleen downwards & medially.

Arterial Supply : splenic a. (tortuous) : br. of Coeliac trunk & runs above the pancreas.

Venous drainage : splenic v. : runs behind body of pancreas to join sup. mesenteric v. (portal).



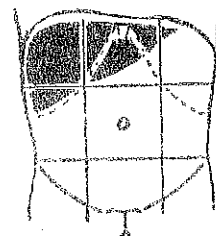
5. LIVER

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* Site: Rt. hypochondrium, epigastrium & extends to the Lt. hypochondrium.

* Size: the largest organ in the body (about $\frac{1}{50}$ of the body weight).

* Shape ; Surfaces & borders: wedge-shaped with its base to the Rt.



- It has 5 surfaces:
- (1) Rt. lat. surface (base).
 - (2) superior surface
 - (3) anterior surface
 - (4) inf. surface
 - (5) posterior surface

- the borders between the surfaces are ill-defined except the inf. border which is sharp.

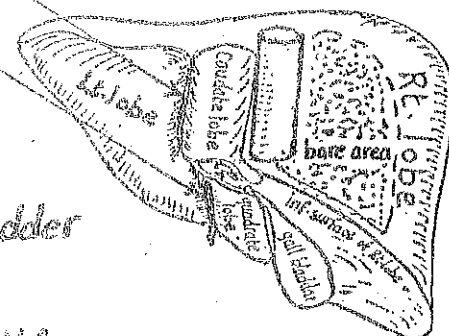
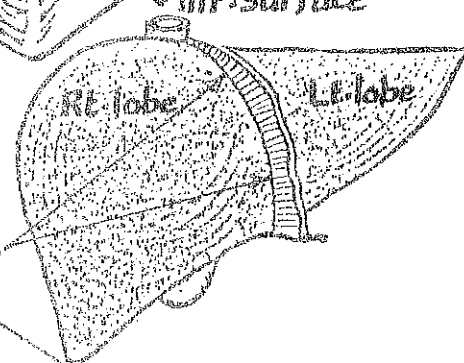
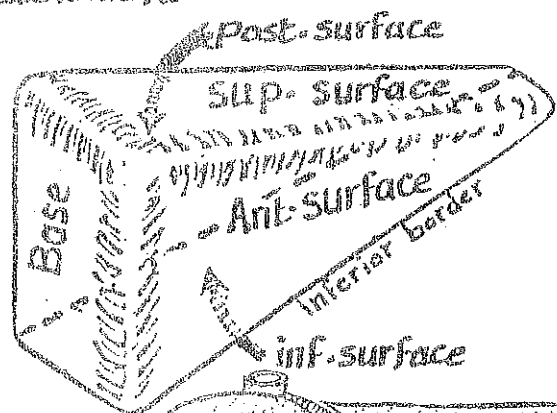
* Lobes of the liver:

(A) Anatomical lobes: morphologically, the liver is divided into large Rt. lobe & small Lt. lobe by:

- (1) the attachment of falciform lig. on the ant. & sup. surfaces
- (2) the fissure for ligamentum venosum on the post. surface
- (3) " " " " teres on the inf. surface

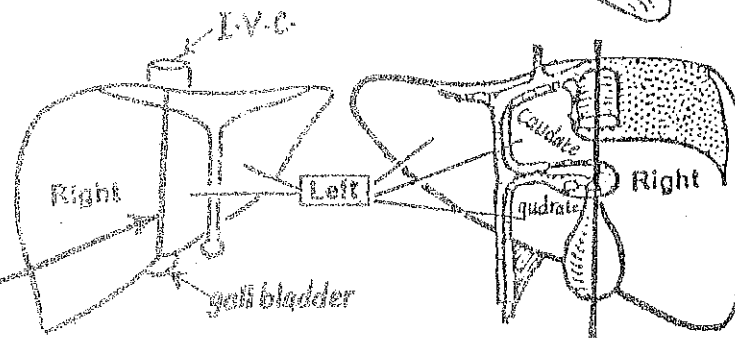
- the Rt. anatomical lobe shows 2 smaller lobes:

- (a) Caudate lobe: on the post. surface, between the I.V.C. & the fissure for ligamentum venosum.
- (b) quadrate lobe: on the inf. surface, between the gall bladder & the fissure for ligamentum teres.



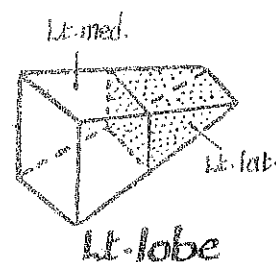
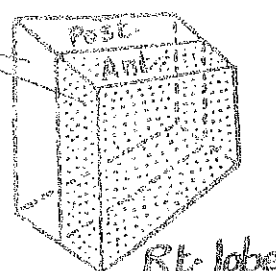
(B) Surgical lobes:

- on the basis of intrahepatic distribution of hepatic a., portal v. & biliary ducts, the liver is divided into 2 nearly equal lobes (Rt. & Lt.) by an antero-posterior plane passing through the gall bladder fossa & groove for I.V.C.



- the surgical Rt. lobe is further divided into:

- (a) Ant. segment
 - (b) post. segment
- each of which is subdivided into sup. & inf. subsegments.



- the surgical Lt. lobe is also divided into 2:

- (a) lat. segment
 - (b) med. segment
- each of which is subdivided into sup. & inf. subsegments.

Relations of the liver

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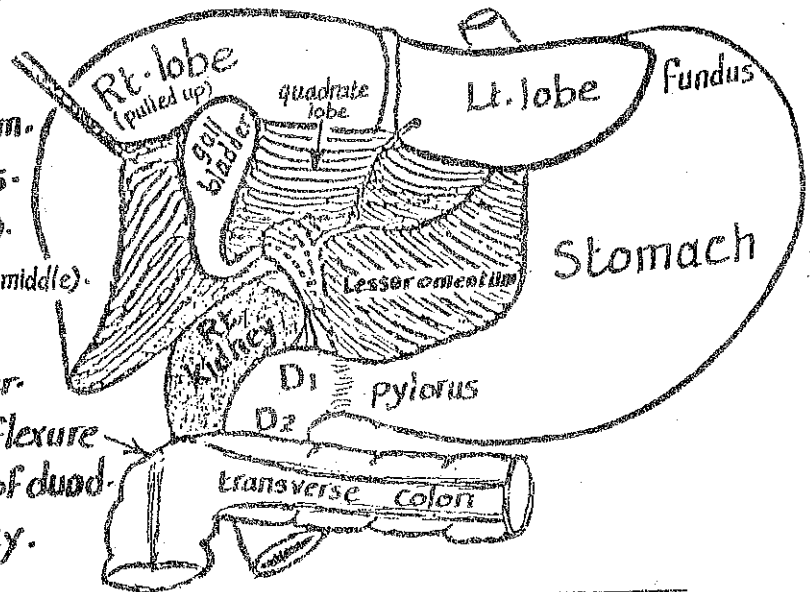
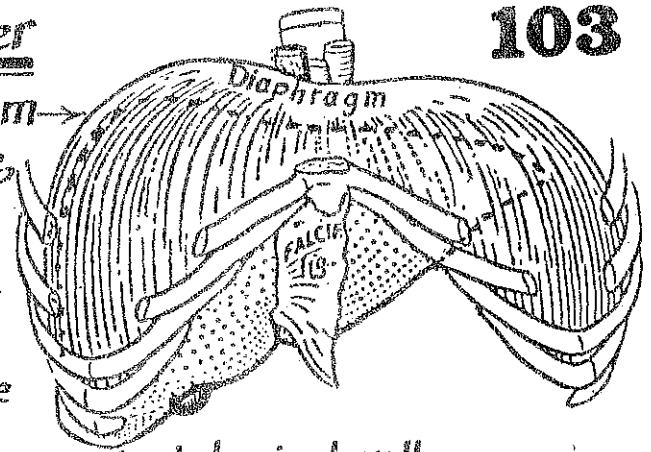
A) Superior surface: related to the diaphragm separating it from bases of both lungs & pleurae, pericardium & heart.

B) Rt. lateral surface (base): related to the diaphragm, separating it from the Rt. lung & pleura & the ribs 6—11 of the Rt. side

C) Anterior surface: diaphragm, xiphoid process & ant. abdominal wall.

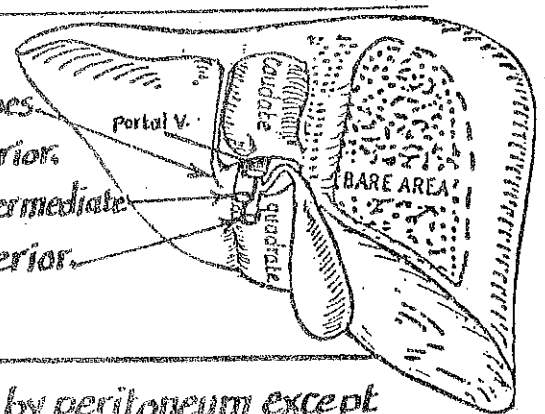
D) Inferior (visceral) surface:

- (1) Lt. lobe: related to stomach & lesser omentum.
- (2) Fissure for ligamentum teres: lodges lig. teres.
- (3) quadrate lobe: (a) lesser omentum (above).
(b) pyloro-duod. junction (in the middle).
(c) transverse colon (below).
- (4) gall bladder fossa: lodges the gall bladder.
- (5) to the Rt. of the gall bladder: (a) Rt. colic flexure
(b) 2nd part of duod.
(c) Rt. kidney.



* Porta hepatis (hilum of the liver):

- it is a transverse fissure between the caudate & quadrate lobes.
- It transmits: (1) portal v. & its branches :--- most posterior.
(2) hepatic a. (surrounded by autonomic nn.) : intermediate
(3) Rt. & Lt. hepatic ducts :----- most anterior.
(4) lymphatics & L.Ns

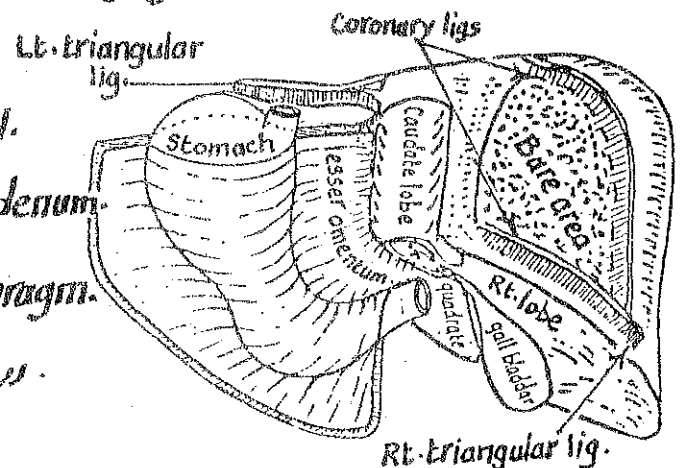


* Peritoneal Covering: the liver is completely covered by peritoneum except the following bare areas: (1) the bare area proper (related to the diaphragm).

(2) fossa for gall bladder (3) groove for I-V-C (4) porta hepatis.

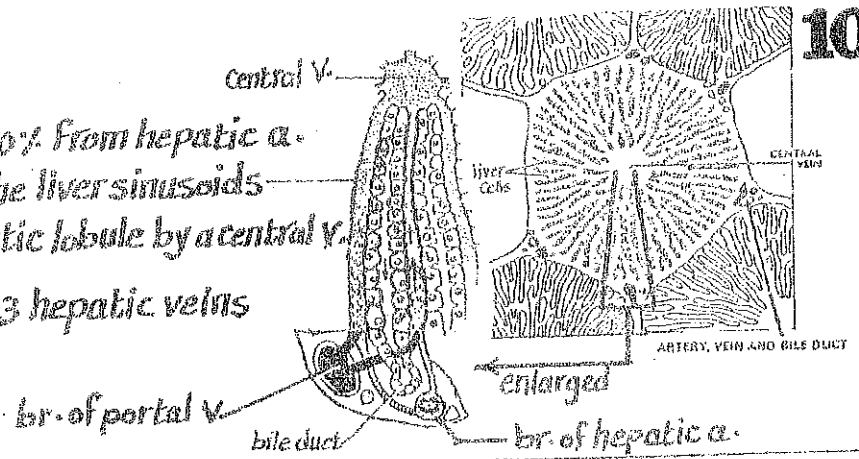
* peritoneal folds of the liver

- (1) Falciform lig.: to diaphragm & ant. abd. wall.
- (2) lesser omentum: to stomach & 1st inch of duodenum.
- (3) Rt. & Lt. triangular ligaments: to the diaphragm.
- (4) upper & lower Coronary



* Blood Supply of the liver :

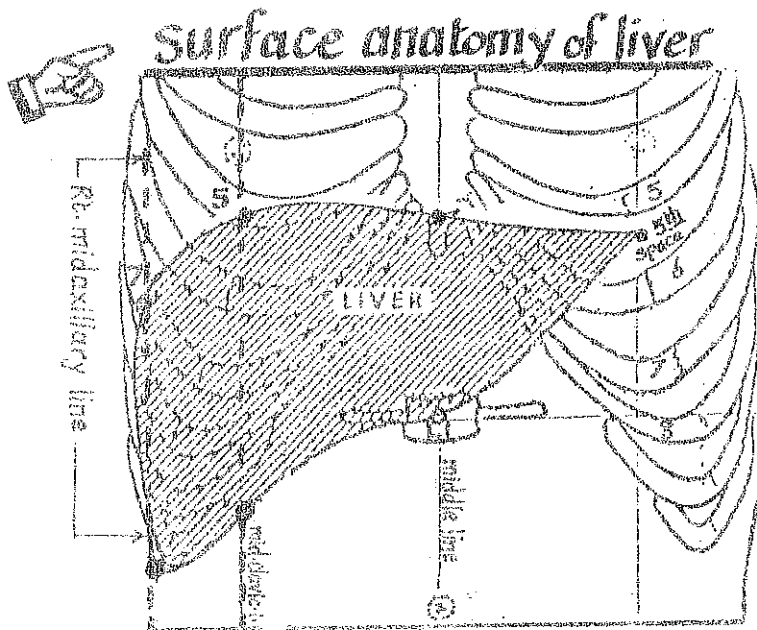
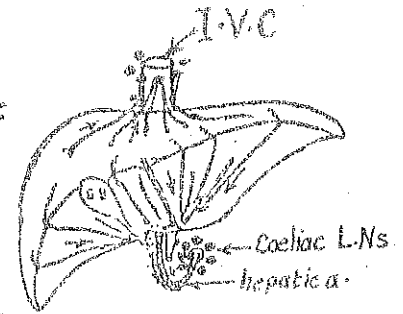
- it is 70% from portal V. & only 30% from hepatic a.
- blood of both vessels is mixed in the liver sinusoids
- the blood is collected from each hepatic lobule by a central V.
- the central veins unite to form 2-3 hepatic veins which open into the I.V.C.



* Lymphatic drainage:

the lymphatics (superficial & deep) pass through the following routes:

- (1) the lymphatics of the post-part of the liver follow the I.V.C. to end in the diaphragmatic L.Ns. around the upper end of I.V.C. in the thorax.
- (2) Lymphatics of the remaining part of the liver follow the hepatic a. to end in the Coeliac L.Ns around the Coeliac trunk.



* The Upper border : represented by a line joining the following points :

- (1) a point on the Lt. 5th intercostal space at the Lt. lat-vertical plane
- (2) a point at the xiphisternal junction
- (3) a point on the Rt. 5th rib on the Rt. lat-vertical plane.
- (4) a point on the Rt. 7th rib in the midaxillary line.

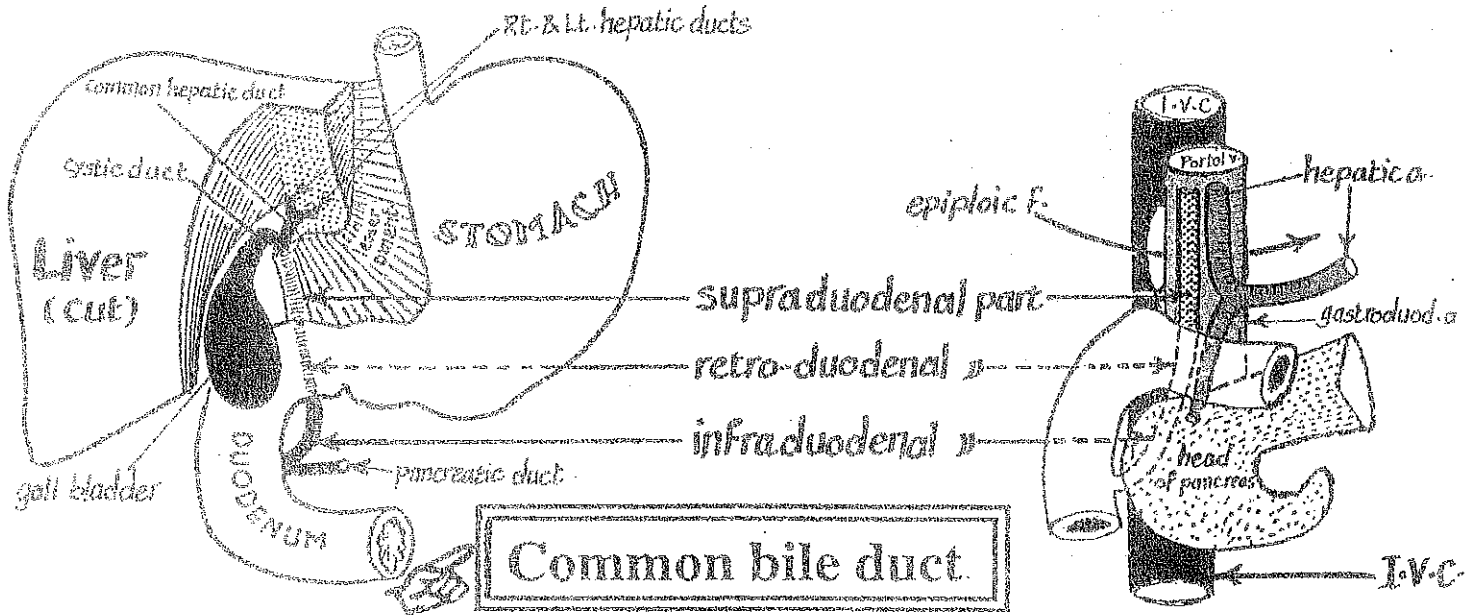
* The lower border : is marked by joining the following points :

- (1) point on the Lt. 5th intercostal space in the Lt. lat-vertical plane.
- (2) point on the Lt. costal margin at the tip of the Lt. 8th costal cartilage.
- (3) point at the transpyloric plane in the middle line.
- (4) points 1 cm below costal margin in the Rt. lat-vertical & Rt. midaxillary lines.

EXTRA-HEPATIC BILIARY PASSAGE

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- (a) Rt. & Lt. hepatic ducts emerge from the Rt. & Lt. lobes of the liver.
- (b) common hepatic duct : formed by the union of the Rt. & Lt. hepatic ducts below porta hepatis.
- (c) Cystic duct : S-shaped duct (4 cm) arising from the neck of gall bladder.
- (d) Common bile duct :



Common bile duct.

* Formation : formed below the porta hepatis by the union of cystic & common hepatic ducts.

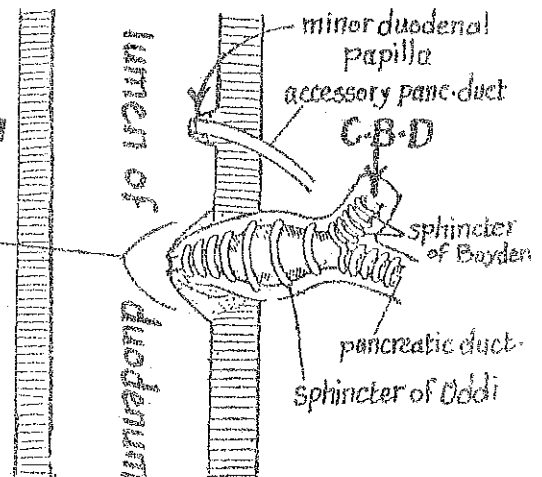
* Length & parts : 3" long, $\frac{1}{4}$ " wide - It is divided into 3 parts :

Part	Course	relations
Supraduodenal	descends in the free margin of lesser omentum	- Anteriorly : liver. - posteriorly : portal v., epiploic f. - on the Lt. side : hepatic artery.
Retroduodenal	descends behind the 2nd inch of 1st part of duoden.	- ant. : 1st part of duodenum - post. : portal v. & I.V.C. - on the Lt. side : gastroduodenal a.
Infraduodenal	passes in a groove on the post. surface of the head of pancreas, or even embedded in it	- ant. : head of pancreas (it may be compressed by cancer head → obstructive jaundice). - post. : I.V.C.

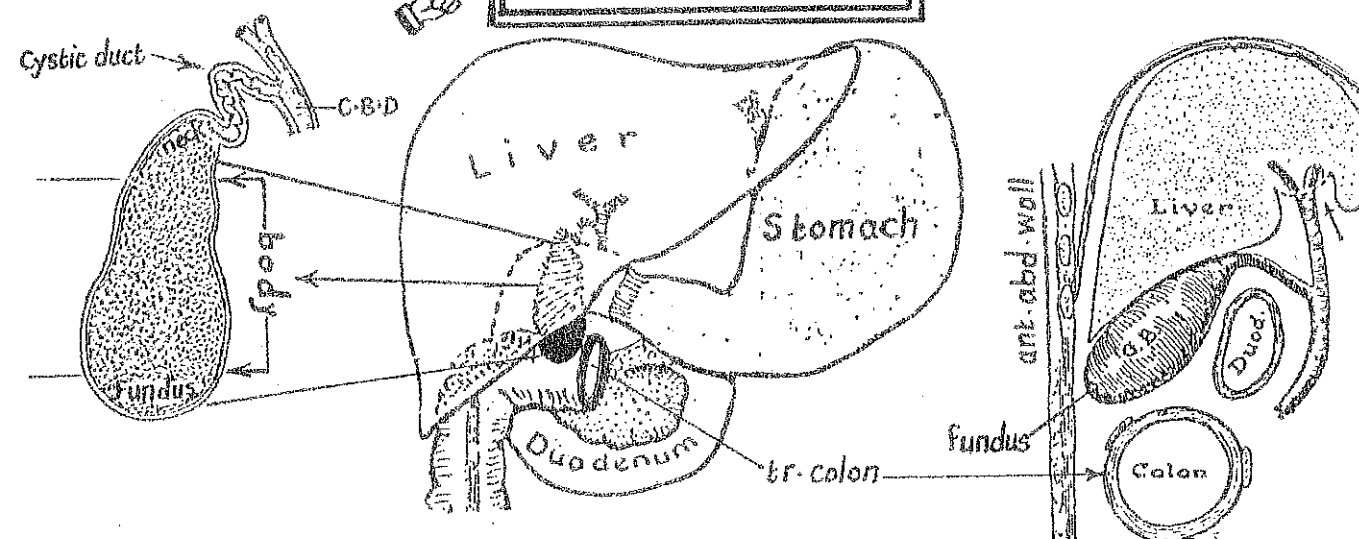
* Termination of C.B.D.

the terminal part of the C.B.D unites with the main pancreatic duct to form the ampulla of Vater which opens at the summit of the major duodenal papilla at the middle of the posteromedial aspect of 2nd part of duodenum (surrounded by the sphincter of Oddi).

- (1) the C.B.D may open separately in the lumen of the duodenum.
- (2) the intra-mural part of the C.B.D, before entering the ampulla, is surrounded by the sphincter of Boyden.



Gall bladder



* Site : gall bladder fossa on the inf. surface of Rt. lobe of liver. (attached to it by loose C.T. & by small veins passing from gall bladder to the liver).

* Size : 7-10 cm. long & 3 cm. broad (at its widest part) & about 30-50 cc in capacity.

* Parts & relations : it consists of fundus, body & neck. :

(A) Fundus : projects beyond the inf. border of the liver.

- Relations :
 anteriorly : ant.-abdominal wall.
 posteriorly : Transverse Colon.

(B) Body : in contact with G.B. fossa of liver. It is covered by peritoneum inferiorly.

- Relations :
 anterosuperiorly : liver.
 postero inferiorly : tr. colon & 1st part of duodenum.

(C) Neck : it is the narrow upper end of G.B. which is continuous with the cystic duct.
 - its posteromed. wall is dilated to form Hartmann's pouch.

- Relations : - sup. : liver inf. : end of 1st part of duodenum.

* Arterial supply : cystic artery :

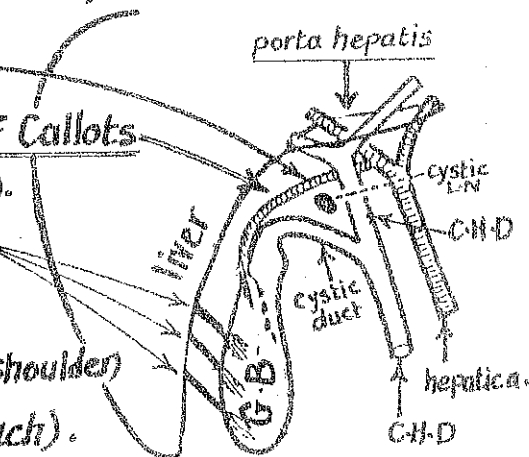
arises from Rt. br. of hepatic a. & passes in the Δ of Callots (between cystic duct, R.H.D., C.H.D & inf. surface of liver).

* Venous drainage : cystic veins : open directly into liver

* Nerve supply :

- sensory : Rt. phrenic n : C_{3,4,5} (pain referred to Rt. shoulder)
 - parasymp. : by vagus (pain via vagus is referred to stomach).
 - symp. : T₇₋₉ (pain via symp. is referred to inf. angle of Rt. scapula).

* Surface anatomy : the fundus of G.B. corresponds to the tip of the Rt. 9th costal cartilage (where linea semilunaris meets the Rt. costal margin).



7-PANCREAS

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* Type : mixed gland $\left\{ \begin{array}{l} \text{endocrine : secretes insulin, glucagon \& gastrin.} \\ \text{exocrine : " pancreatic juice.} \end{array} \right.$

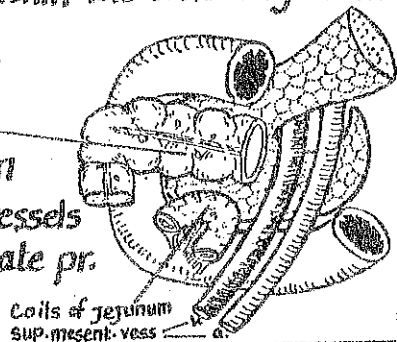
* Site : it is a retroperitoneal elongated gland lying transversely across the upper part of post-abd. wall, extending from the concavity of the duodenum on the Rt. to the spleen on the Lt.

* Parts & relations : it consists of head, neck, body & tail.

(A) Head : lies within the concavity of the duodenum & has a projection called uncinete process.

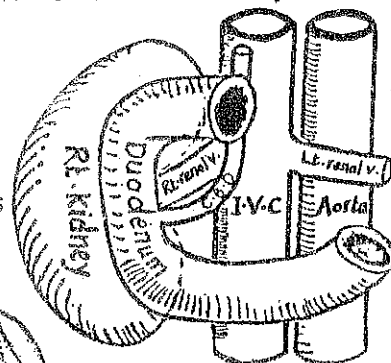
- Ant. relations :

- (1) tr. colon
- (2) coils of jejunum
- (3) sup. mesent. vessels in front of uncinete pr.



- post. relations :

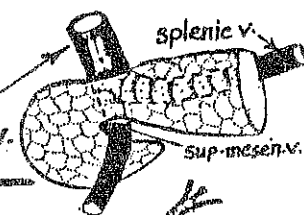
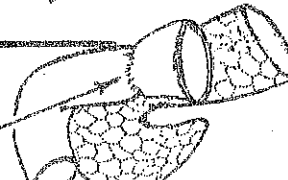
- (1) common bile duct
- (2) I.V.C & termination of Rt. & Lt. renal veins
- (3) aorta : behind uncinete process.



(B) - Neck : the constricted part following the head.

- Ant. relation : pyloroduodenal junction

- post. relation : junction between splenic & sup. mesent. v. to form portal v.



(C) - Body : triangular in cross-section having 3 borders & 3 surfaces

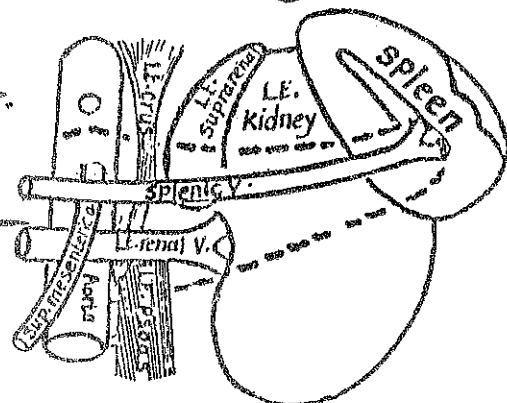
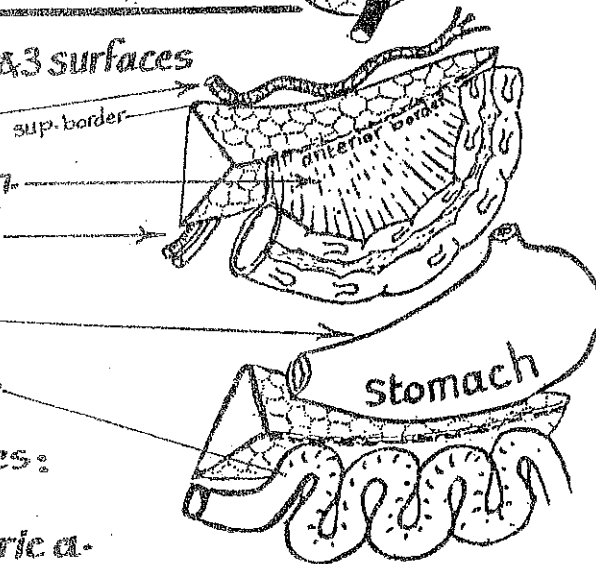
- (1) sup. border : related to the splenic artery.
- (2) ant. border : gives attachment to transverse mesocolon.
- (3) inf. border : related to sup. mesent. vessels at its Rt. end

(4) ant. surface : related to lesser sac & stomach

(5) inf. surface : related to D.J. flexure & coils of jejunum.

(6) post. surface : related to the following structures :

- (a) 2 arteries : abd. aorta & origin of sup. mesenteric a.
- (b) 2 veins : splenic v. & Lt. renal v.
- (c) 2 muscles : Lt. crus of diaphragm & Lt. psoas major.
- (d) 2 glands : Lt. suprarenal g. & Lt. kidney.
- (e) Lt. sympathetic chain.



(D) - Tail : passes through the lino-renal lig. to reach the hilum of spleen. (closely related to splenic vess.).

* Arterial Supply : (1) pancreatic brs. of splenic a.

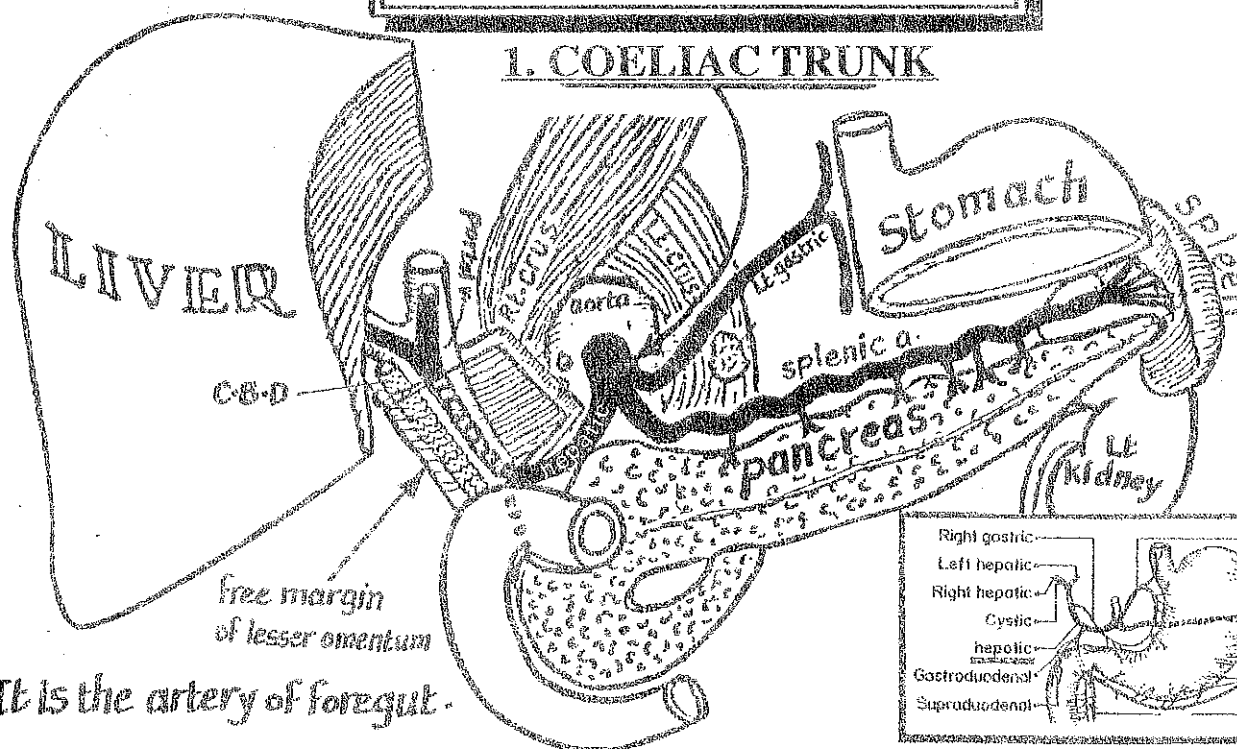
(2) sup. pancreatico-duodenal a. (br. of gastroduodenal a.).

(3) inf. " " " (br. of sup. mesenteric a.).

ARTERIAL SUPPLY OF GUT

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1. COELIAC TRUNK



It is the artery of foregut.

- * Origin: from the front of abd. aorta at the upper border of L1.
- * Course: it passes forwards for $\frac{1}{2}$ " in front of aorta, above the pancreas.
- * Relations: (1) on each side: crus of diaphragm, coeliac ganglion & coeliac L-Ns.
(2) anteriorly: cavity of lesser sac separating it from lesser omentum.
(3) superiorly: median arcuate lig. (4) inferiorly: pancreas
- * Branches: it ends by dividing into 3 terminal branches: hepatic, splenic & Lt gastric
 - (1) Lt. gastric a. (smallest br.): passes towards the cardiac end of the stomach. it gives br. to the oesophagus then descends along lesser curvature of stomach to anastomose with the Rt. gastric artery.
 - (2) Splenic a. (the largest br. & is tortuous): it passes to the Lt. side above the upper border of pancreas (behind the stomach) & gives the following brs:
 - (a) pancreatic br. to supply the body & tail of pancreas.
 - (b) & (c) Lt. gastroepiploic & short gastric: to supply the stomach.
 - (d) 5 or 6 terminal splenic brs. to the spleen (end arteries).
 - (3) Hepatic a.: (intermediate in size): it passes towards the pyloric end of stomach then ascends in the free margin of lesser omentum (in front of portal v. & to the Lt. side of C.B.D) to reach the porta hepatis.
 - branches: (a) Rt. gastric a.
 - (b) gastroduodenal a.: descends behind 1st part of duodenum & divides into Rt. gastroepiploic & sup. pancreaticoduodenal
 - (c) supraduodenal a.
 - (d) Rt. & Lt. terminal brs. to the Rt. & Lt. lobes of the liver.

2. SUP. MESENTERIC A.

* It is the artery of midgut.

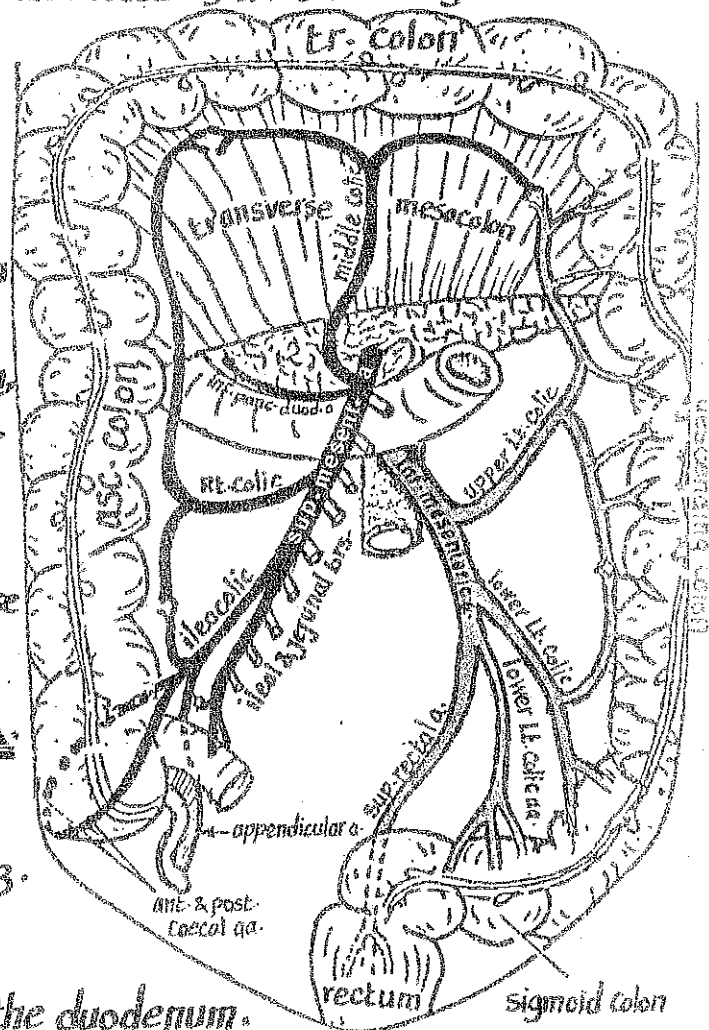
* Origin: from the front of abd. aorta at the lower border of L1.

* Course & relations:

- at its origin it lies behind the pancreas then crosses in front of uncinat process of pancreas & 3rd part of duodenum lying to the Lt. side of its vein.
- it enters the root of mesentery, passes downwards & to the right, having the same relations as the root of mesentery to end in the Rt. iliac fossa by anastomosing with a br. of the ileocolic a.

* Branches:

- (1) inf. pancreatico-duodenal a.: supplies lower $\frac{1}{2}$ of duodenum + head of pancreas.
- (2) jejunal & ileal brs. (12-16): supply the jejunum & ileum (except its terminal part).
- (3) ileo-colic a.: supplies the terminal part of ileum, caecum, appendix & lower $\frac{1}{3}$ of ascending colon.
- (4) Rt. colic a.: supplies the upper $\frac{2}{3}$ of ascending colon + the Rt. colic flexure.
- (5) middle colic a.: supplies the Rt. $\frac{2}{3}$ of transverse colon.



3. INF. MESENTERIC A.

* It is the artery of the hindgut.

* Origin: front of abd. aorta at the level of L3.

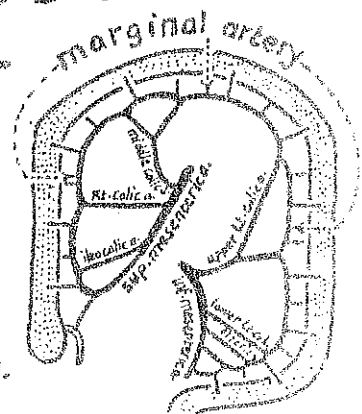
* Course & relations:

- at its origin, it lies behind the 3rd part of the duodenum.
- it runs downwards & to the Lt. behind the peritoneum, lying med. to the inf. mesent. v.
- it ends by becoming the sup. rectal a. in front of the Lt. common iliac a.

- * Branches:
- (1) upper Lt. colic a.: supplies the Lt. $\frac{1}{3}$ of tr. colon + descending colon.
 - (2) lower Lt. colic (sigmoid) arteries: 2-3 supplying sigmoid colon.
 - (3) sup. rectal a.: to the rectum & anal canal.

Marginal artery

* it is a continuous arterial arcade lying along the concavity of the colon 1-1 $\frac{1}{2}$ " from the colon. It is formed by anastomosis of ileocolic, Rt. colic, middle colic, upper & lower Lt. colic arteries. It gives rise to straight brs. called Vasa recta (end arteries) which supply the colon.



PORTAL VEIN

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* **Origin** : it begins behind the neck of pancreas by the union of 2 veins:

splenic v. & sup. mesenteric v.

* **Termination** : in the porta hepatis, by dividing into 2 brs. : Rt. & Lt.

* **Length** : 2-3 inches.

* **Course & relations** : it has 2 parts:

(1) **retroduodenal part** : ascends behind the 1st part of duodenum lying in front of the

I.V.C. & behind the gastroduodenal a. & C.B.D

(2) **Supraduodenal part** : ascends in the free margin of lesser omentum, having the following relations:

- posteriorly : epiploic foramen separating it from I.V.C. (b) anteriorly : hepatic a. & C.B.D

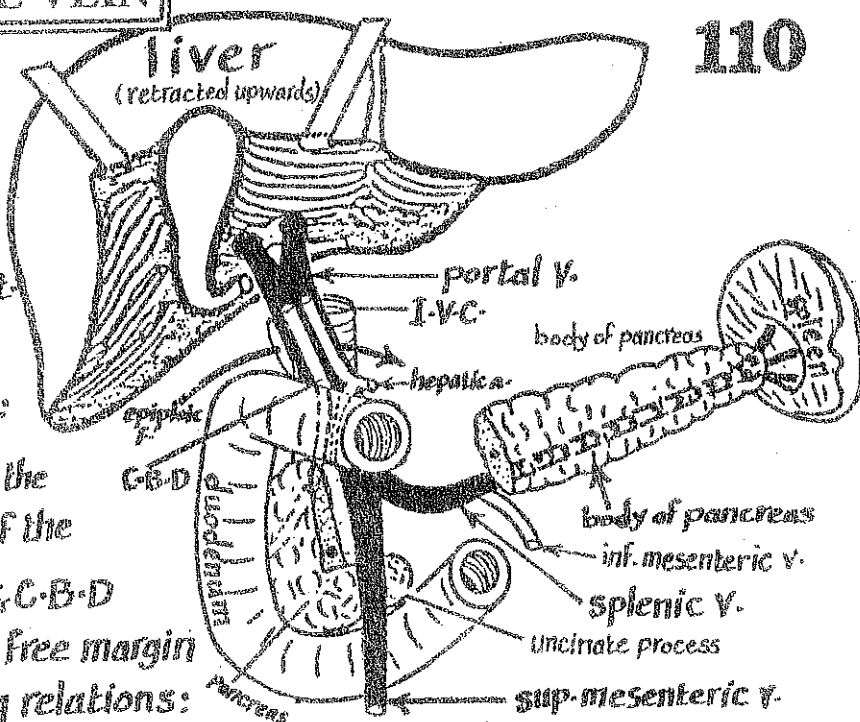
* **Tributaries** :

(1) splenic v. which receives tributaries corresponding to brs. of splenic a. + inf. mesenteric v.

(2) sup. mesenteric v. which receives tributaries corresponding to brs. of sup. mesenteric a. + Rt. gastroepiploic v.

(3) Rt. & Lt. gastric veins. The Lt. v. receives oesophageal veins.

(4) paraumbilical (from umbilicus) : ends in the Lt. br. (5) cystic v. from G.B. to the Rt. br.



PORTAL CIRCULATION

- It is represented by the portal v. & its tributaries which drain the venous blood of the G.I.T.

- It begins with capillaries in the walls of the G.I.T. & ends with capillaries in the liver.

- it is devoid of valves & has a pressure of 7-11 mm Hg. (10-15 cm H₂O).

SITES OF PORTO-SYSTEMIC ANASTOMOSIS

(1) **At the lower end of oesophagus** : between oesophageal brs. of Lt. gastric v. (portal) & oesophageal brs. of azygos v. (systemic).

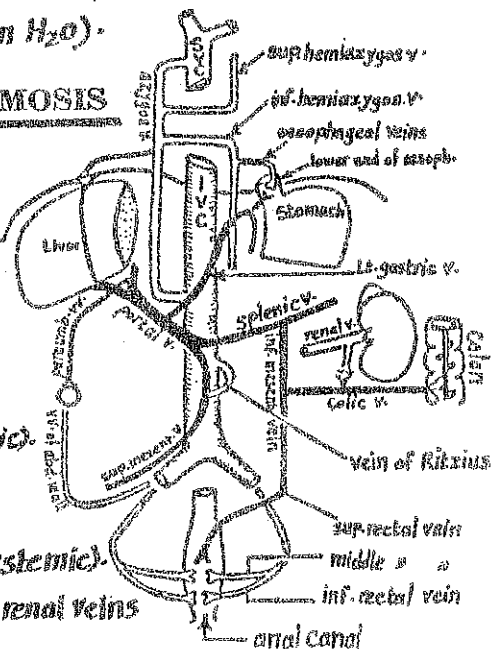
(2) **At the anal canal** : between sup. rectal v. (portal) & middle & inf. rectal veins (systemic).

(3) **Around the umbilicus** : between paraumbilical veins (portal) & the superficial vv. of ant. abd. wall (systemic).

(4) **At the bare area of diaphragm** : between veins of the liver (portal) & the phrenic veins (systemic).

(5) **Around kidneys** : between Rt. & Lt. Colic vv. (portal) & Rt. & Lt. renal veins (systemic).

(6) **the Vein of Ritzius** connects the sup. mesenteric v. (portal) with the I.V.C. (systemic).



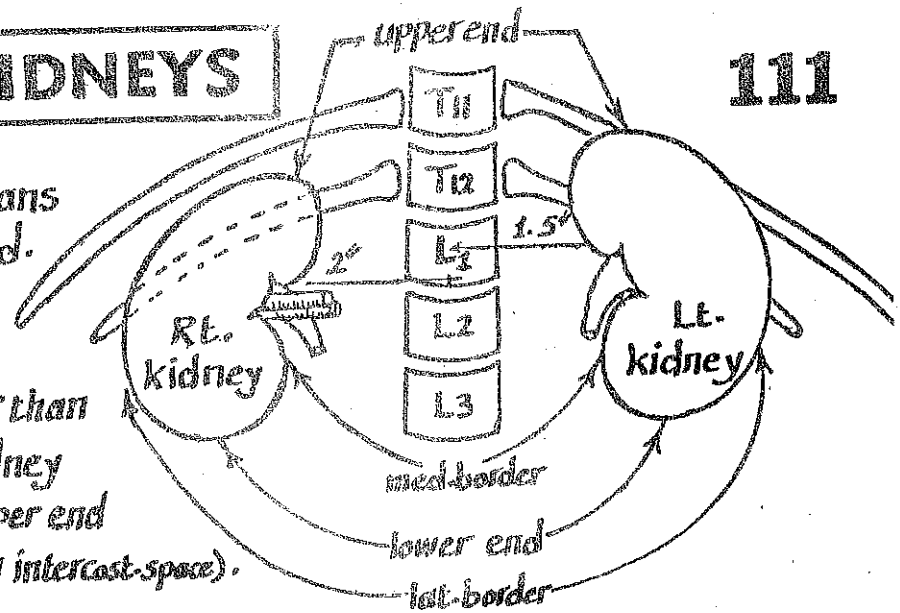
KIDNEYS

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* Size: 12 x 6 x 3 cm.

* Site: they are retroperitoneal organs lying on the upper part of post. abd. wall opposite the last thoracic & the upper 3 lumbar vertebrae.

N.B: the Rt. kidney is $\frac{1}{2}$ inch lower than the Lt. (the upper end of Lt. kidney reaches the 11th rib while the upper end of the Rt. kidney reaches the 11th intercost-space).



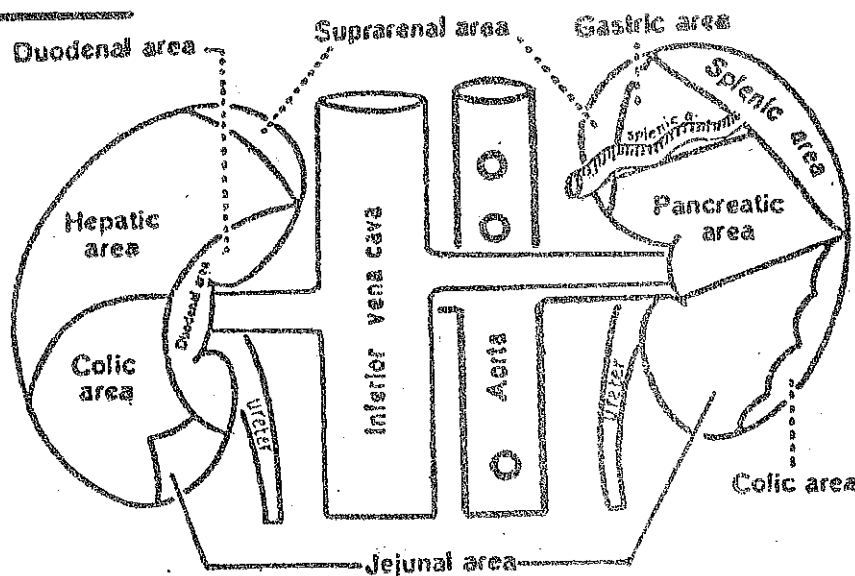
* Shape: bean shaped having:

- 2 ends (upper & lower): the upper end is nearer to the median plane than the lower.
- 2 borders: lat. Convex border & med. concave border presenting the hilum at its middle.
- 2 surfaces: ant. (related to abd. organs) & post. (applied to the post. abd. wall).



Relations

(A) Anterior relations:



Ant-relations of Rt. kidney	Ant-relations of Lt. kidney
(1) Rt. suprarenal gland	(1) Lt. Suprarenal gland.
(2) Second part of duodenum.	(2) Stomach.
(3) Liver	(3) Spleen
(4) Rt. colic flexure	(4) descending colon.
(5) Coils of jejunum	(5) Coils of jejunum.
(6) Ascending br. of Rt. colic a.	(6) Ascending br. of Lt. colic a.
	(7) body of pancreas & splenic vessels.

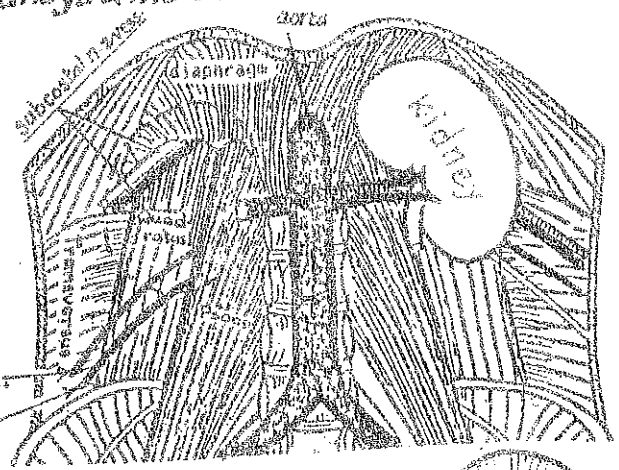
(B) Posterior relations: similar for both kidneys & include:

Index

- (1) diaphragm
- (2) psoas major.
- (3) quadratus lumborum.
- (4) transversus abdominis.

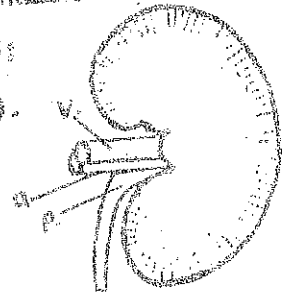
II-4 neurovascular structures

- (1) subcostal vessels.
- (2) " nerve.
- (3) iliohypogastric nerve.
- (4) ilio-inguinal nerve.



* Hilum of the kidney: lies in the middle of the med. border & transmits:

- (1) V renal v. (most ant.): ends in the I.V.C. (the Lt. v. is longer than the Rt.).



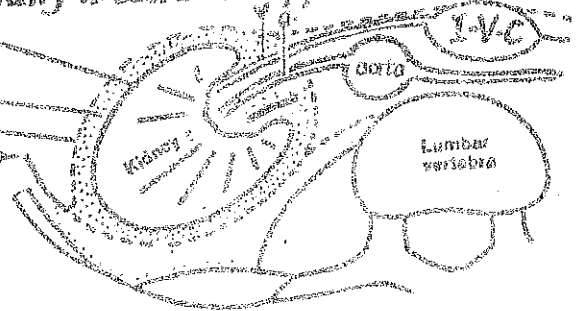
* Capsules (coverings) of the kidney: from inside outwards there are:

- (i) **Fibrous Capsule**: closely invests the kidney. Normally it can be stripped off easily.

- (c) Fatty capsule (perinephric fat)

- (3) Fascial capsule (Zuckermandel fascial):

- it is derived from fascia transversalis
- its 2 layers are fused above the kidney but remain separate below (allow ptosis of the kidney).



* Stability of the Kidney : depends on :

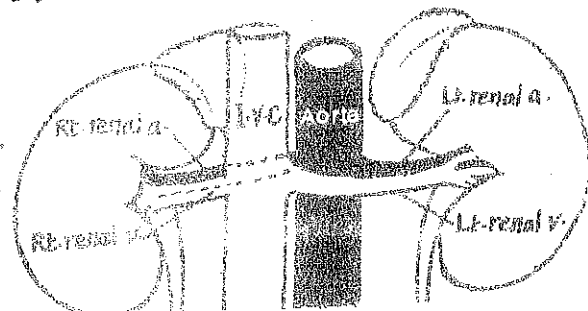
- (1) its position in the depth of the paravertebral gutter. (2) its fascial & fatty capsules.
(3) the renal vessels connecting the kidney to the aorta & I.V.C. (4) the intra-abdominal pressure.

* Arterial Supply: Renal a.: br. of abd. aorta at L2.

- the Lt. renal a. is short & passes behind the Lt. renal v.
- the Rt. " " " " " long & passes behind IVC & Rt. v. "

x Venous drainage : Renal V. : drains into I.V.C.

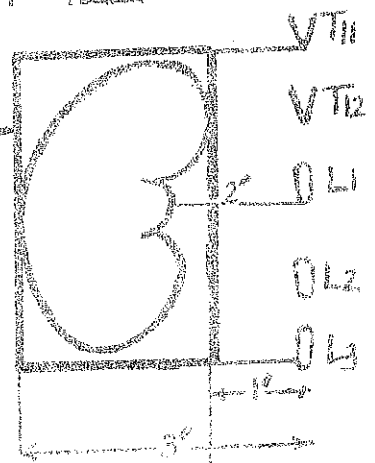
- the Rt. renal v. is short & passes in front of Rt. renal a.
- Lt. " " " long " " " abd. aorta & Lt. renal a.



* Surface anatomy: Morris parallelogram:

3. On the back of the patient, draw the following lines:

- 2 vertical lines (1 inch & 3 inches from the median plane).
- 2 horizontal lines (at the level of T1 & L3 spines).
- the centre of the hilum lies opposite the lower border of L1 spine
2" from the median plane.



URETERS

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* Site & Size: it is a thick-walled retro-peritoneal muscular tube, 25-30 cm long & 6 mm. in diameter.

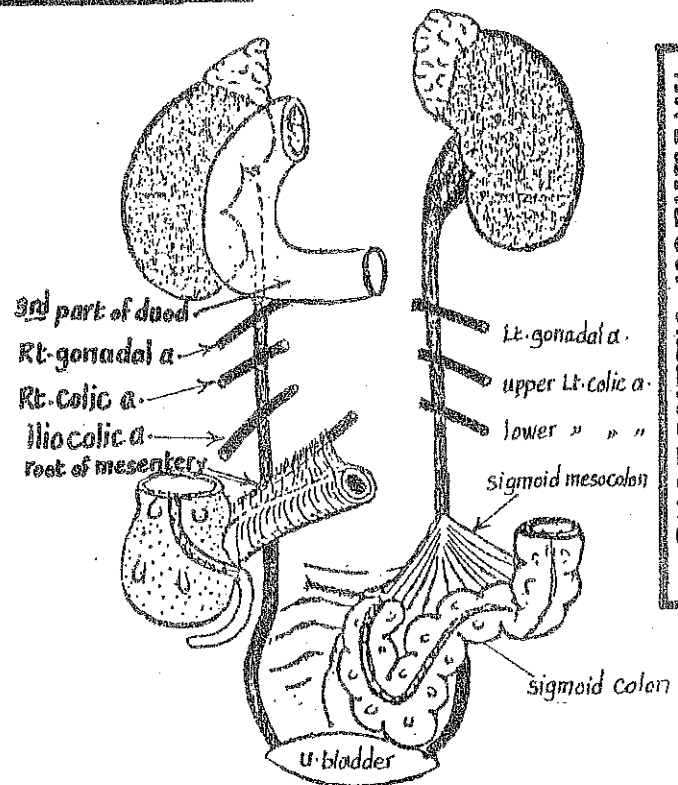
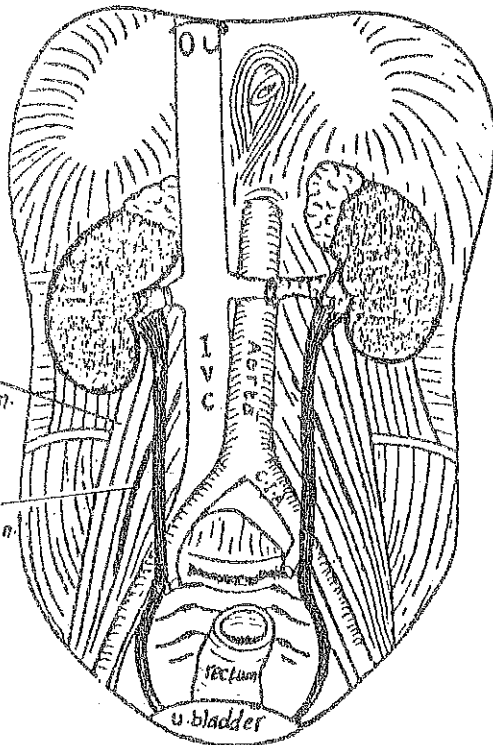
* Beginning: at the pelvi-ureteric junction, in front of the tip of tr. process of L1.

* Termination: by opening into the postero-superior angle of urinary bladder.

* Course: divided into 3 parts:

- (1) abdominal part: its upper 1/2 (on post-abd. wall).
- (2) pelvic part: its lower 1/2 (on lat. wall of pelvis).
- (3) intra-mural part: last 2 cm (inside bladder wall)

A. Abdominal Part:



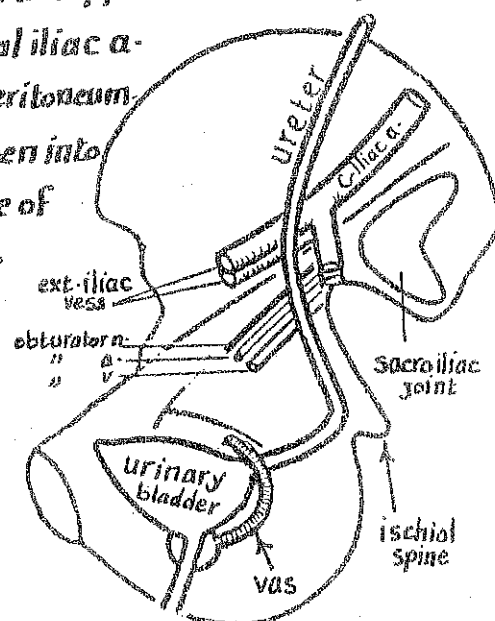
	Rt. ureter	Lt. ureter
Course	each ureter descends vertically behind the peritoneum of post-abd. wall opposite the tips of tr. processes of the lower 4 lumbar vertebrae.	
Posterior relations	(1) med. border of psoas major (& minor) & genito femoral n. on it. (2) tips of tr. processes of the lower 4 lumbar vertebrae (behind psoas).	
Anterior relations	(1) 3rd part of duodenum (2) 3 arteries: (a) Rt. gonadal a. (b) Rt. colic a. (c) ilio colic a. (3) 3 Structures related to Mesentery its root, sup. mesenteric vessels & coils of ileum	(1) 3 arteries (a) Lt. gonadal a. (b) upper Lt. colic a. (c) lower " " " (2) Sigmoid Mesocolon & coils of sigmoid Colon.
Med. relations	Inf. vena cava (I.V.C)	Inf. mesenteric vein (I.M.V.)

B. Pelvic Part:

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Course & relations:

- 1) it enters the pelvis by crossing in front of the bifurcation of C.iliac a. (opposite sacro-iliac joint).
- 2) it runs downwards & backwards along the lower border of internal iliac a. crossing ext.iliac vess., obturator n. & vess. & covered medially by peritoneum.
- 3) opposite the ischial spine, the ureter curves anteromedially to open into the postero-sup. angle of urinary bladder. Here it passes on the side of vagina in the female & is crossed by the vas deferens in the male.



C. Intramural Part:

it is 2 cm long, & runs an oblique course in the bladder wall.

* Constrictions of the ureter:

- (1) at the pelvi-ureteric junction.
- (2) at the pelvic brim.
- (3) opposite the ischial spine.
- (4) its intra-mural part.

* Blood supply of the ureter: it receives a rich segmental supply from the following arteries:

Aorta, Renal a., Testicular (or ovarian) a., Inf. vesical a. & Common iliac a.

* Identification of the ureter at operation:

- (1) it appears as thick muscular tube with longitudinal blood vessels along its wall.
- (2) it shows peristalsis & gives urine on aspiration.
- (3) it crosses in front of the bifurcation of the common iliac a.

SUPRARENAL GLANDS

	Rt. Suprarenal Gland	Lt. Suprarenal gland
Site	higher, lying on the upper pole of kidney	lower, reaching the hilum of the kidney
Shape	Triangular	semilunar
Hilum	directed upwards	directed downwards
Vein	very short & drains into the I.V.C	long v. draining into Lt. renal v.
post. relations	Rt. crus of diaphragm	Lt. crus of diaphragm.
ant. relations	I.V.C & bare area of the liver	lesser sac & stomach
med. relations	Coeliac Ganglion	
Arterial Supply	(1) sup. suprarenal a. : br. of phrenic a. (2) middle " " : " " abd. aorta. (3) inferior " " : " " renal a.	

Urinary bladder

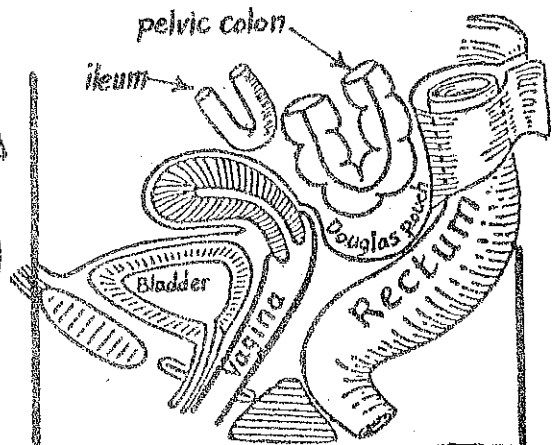
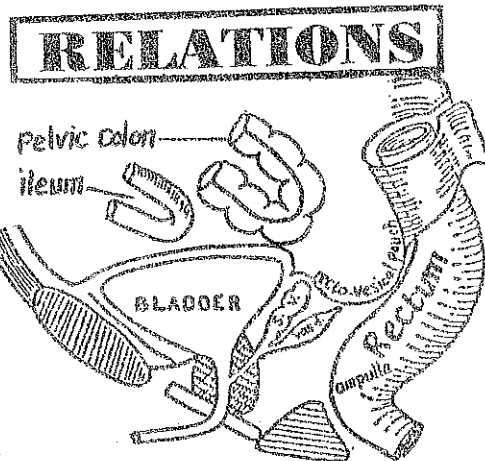
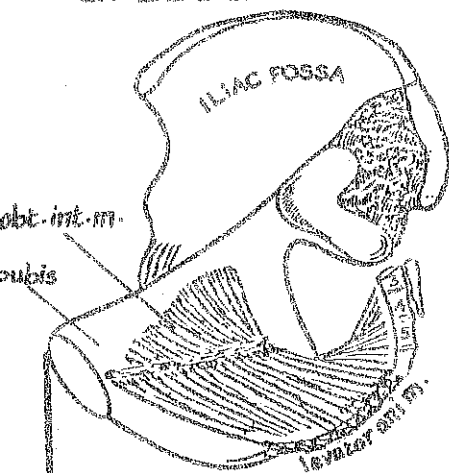
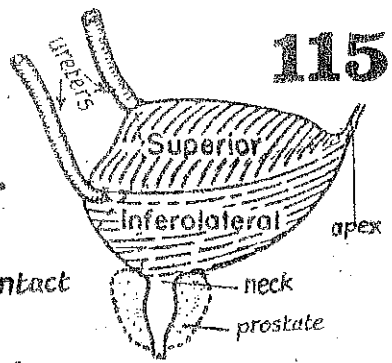
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- * Site : a- at birth it lies in the abdominal cavity.
 b- in the adult it occupies the ant. part of the pelvis.
 When distended, it expands upwards into the abdominal cavity & strips the peritoneum of ant. abd. wall, coming in contact with fascia transversalis.

* Shape : the full bladder is ovoid but when empty it is a 4-sided pyramid having:

- (A) 4 angles : - anterior (apex) : behind S. pubis & gives attachment to med. umbilical lig.
 - inferior (neck) : lying on prostate (♂) or pelvic fascia (♀), gives the urethra.
 - 2 postero superior angles : receiving the 2 ureters.

(B) 4 surfaces : superior surface, post. surface (base) & 2 inferolateral surfaces



In both ♂ & ♀

In the Male

In the Female

Inferolateral Surface:

- (1) pubis & retro-pubic fat.
- (2) obturator internus m.
- (3) levator ani m.

- Superior surface : related to coils of ileum & pelvic colon
- post. surface (base) : related to the 2 seminal vesicles, 2 vasa deferentia & rectum

- Superior surface : related to uterus & uterovesical pouch.
- post. surface (base) : related to cervix & vagina.

Interior of the bladder:

the mucosa shows folds (rugae) except the trigone which is smooth.

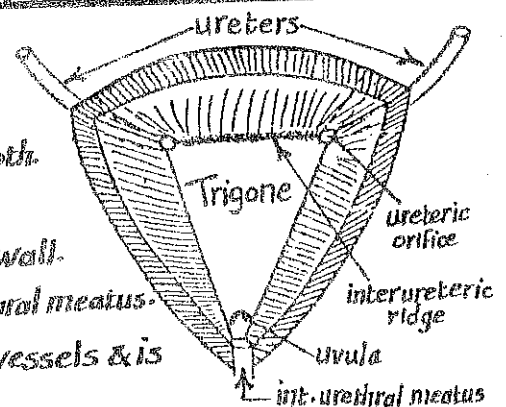
* The trigone

- it is a triangular area on the inner aspect of the post-bladder wall.
- it is bounded by 3 lines connecting the 2 ureteric orifices & int. urethral meatus.
- it shows: (1) smooth mucosa which is richly supplied by nerves & vessels & is

firmly adherent to the underlying muscle coat.

(2) inter-ureteric ridge : a transverse ridge between the 2 ureteric orifices.

(3) uvula vesicae : a slight elevation on the trigone immediately behind the internal urethral meatus (formed by median lobe of prostate).



* Lobes of the prostate :

- the urethra & the 2 ejaculatory ducts traverse the prostate dividing it into the following 5 lobes:

(1) Ant. lobe :

- it is a small isthmus connecting the 2 lat. lobes in front of urethra.
- it contains little or no glandular tissue (rarely forms adenoma)

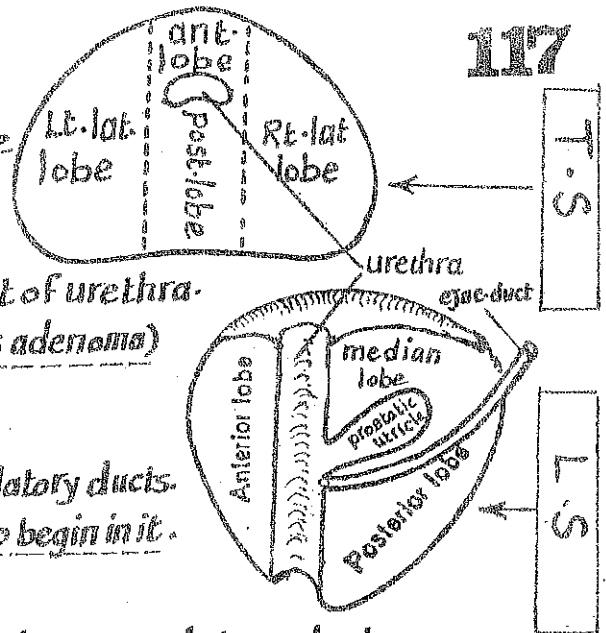
(2) Post. lobe :

- it connects the 2 lat. lobes behind the urethra.
- it lies below & behind the median lobe & the 2 ejaculatory ducts.
- adenoma never occurs here but 1/3 carcinoma is said to begin in it.

(3) Median lobe :

- it lies behind the upper part of urethra & in front of the 2 ejaculatory ducts.
- it produces an elevation in the lower part of the trigone of bladder (uvula vesicae).
- it contains much glandular tissue & is the common site for adenoma.

- (4) & (5) Rt. & Lt. lateral lobes: lie on each side of the urethra. They contain enough glandular tissue (may cause adenoma in old age).

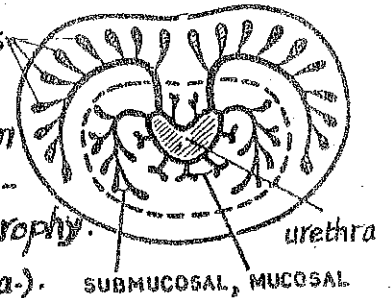


* Structural Zones of prostate : histological sections show 2 concentric zones:

- (1) outer larger zone (mainly in the post. lobe) formed of large glands

This is the exclusive zone for carcinoma.

- (2) Inner smaller zone: surrounding the urethra (mainly in the median & the 2 lat. lobes). It contains mucosal & sub-mucosal glands & is prone to benign hypertrophy.



* Arterial Supply: inf. vesical & middle rectal aa. (from int. iliac a.).

* Venous drainage: by the prostatic venous plexus which receives the deep dorsal V. of penis & veins from the bladder base). It drains into int. iliac v. & is connected to the vertebral venous plexus by valveless veins.

* Lymphatic drainage: to internal iliac L.Ns.

urethra

* Male urethra: 8" long, S-shaped & has 3 parts:

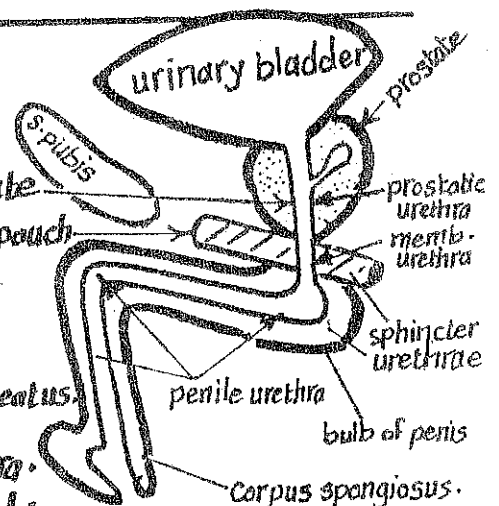
(a) prostatic part: 1 1/2", widest part & traverses the prostate

(b) membranous U: 1/2", narrowest U & traverses deep perineal pouch & is surrounded by sphincter urethrae m

(c) penile urethra: 6" long, traverses the bulb & corpus spongiosus of penis to end at ext-urethral meatus.

* Female urethra: is wider & shorter than male urethra.

It is only 4 cm long & descends straight course, embedded in the ant. wall of vagina to open in the vaginal vestibule 1" behind the clitoris.



Diaphragm

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* Origin:

A) Sternal origin: by 2 slips from back of xiphoid process

B) Costal origin: by slips from the inner surfaces of the lower 6 costal cartilages

C) Vertebral origin:

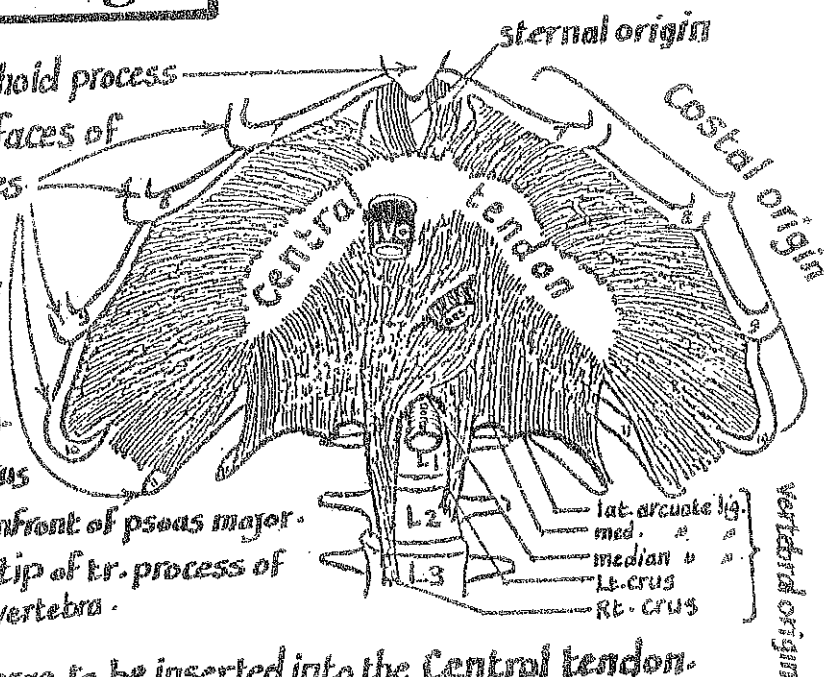
(1) Rt. crus: from bodies of upper 3 L. vertebrae

(2) Lt. crus: from bodies of lower 2 L. vertebrae

(3) median arcuate lig.: between the 2 crura in front of aortic opening

(4) medial arcuate lig. (Rt. & Lt.): between a crus & tip of tr. process of L1 in front of psoas major.

(5) lateral arcuate lig. (Rt. & Lt.): between tip of tr. process of 1st lumbar vertebra.



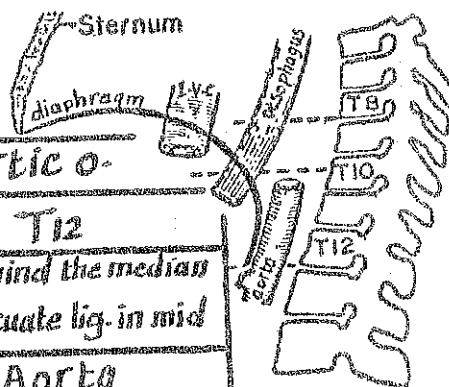
* Insertion: all fibres of origin converge to be inserted into the Central tendon.

* N. Supply: (a) Motor: the phrenic nerves (C3, 4, 5) which supply the diaphragm from its lower surface.
(b) Sensory: lower 6 thoracic ns. to the periphery & phrenic n. to the central part.

* Action: it is the main muscle of inspiration. It also increases the intra abdominal pressure.

* Major foramina of the diaphragm:

opening	Vena caval o.	oesophageal o.	aortic o.
vertebral level	T8	T10	T12
position	in the central tendon 1" to the Rt. of midline	in the Lt. crus of diaphragm 1" to the Lt. of midline	behind the median arcuate lig. in mid
structures passing	(1) I.V.C (2) Rt. phrenic n. (3) lymphatic vessels	(1) oesophagus (2) the 2 vagi (3) oesophageal vessels	(1) Aorta (2) Azygos V. (3) thoracic duct

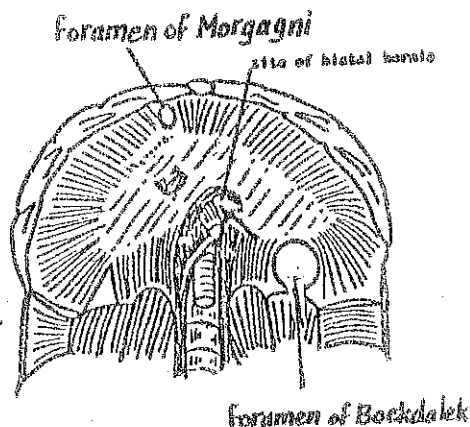


* Defects of the diaphragm:

- these are small spaces, filled with loose areolar tissue, between the different parts of origin of the diaphragm & may be sites of internal hernia. They include:

(1) Foramen of Morgagni: between the sternal & costal origins. It transmits the sup. epigastric vessels & may be the site of ant. (parasternal) diaphragmatic hernia.

(2) Foramen of Bochdalek: between the costal & vertebral origins. It may be the site of post-diaphragmatic hernia.



ABDOMINAL AORTA

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- * Beginning: at the aortic opening of diaphragm
(at the level of lower border of T12)
as a continuation of descending Th. aorta.
- * Course: it descends in front of the bodies of the
upper 4 lumbar vertebrae.
- * End: at the lower border of L4 by dividing into
2 Common iliac arteries.

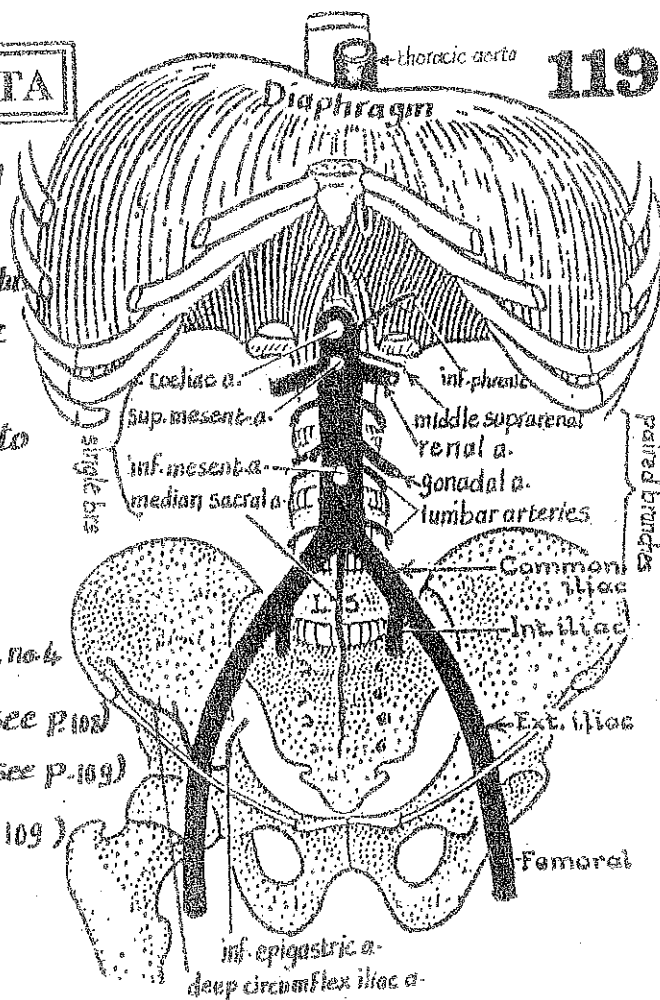
* Branches: single
paired

(A) Single branches: all from the front of aorta except no. 4

- (1) Coeliac trunk: at the upper border of L1 (see p.108)
- (2) Sup. mesenteric a.: " " lower " " (see p.109)
- (3) inf. mesenteric a.: at the level of L3 (see p.109)
- (4) median sacral a.: from back of aorta at L4

(B) Paired branches:

- (1) Rt. & Lt. inferior phrenic arteries----- at level of upper border of L1.
- (2) " " " middle suprarenal arteries----- " " " lower " " "
- (3) Rt. & Lt. renal arteries----- " " " L2
- (4) Rt. & Lt. gonadal arteries----- " " " L3
- (5) 4 pairs of lumbar arteries----- one pair opposite each vertebra.



Common iliac artery (C.I.A)

- * Origin: as one of the 2 terminal brs. of abd. aorta at the lower border of L4.
- * Course: it descends downwards & laterally along the med. side of psoas major m.
- * End: opposite the sacro-iliac joint by dividing into external & internal iliac arteries.

External iliac artery

- * Origin: opposite the sacro iliac joint, as the larger of the 2 terminal brs. of C.iliac a.
- * Course: it descends downwards & laterally along the med. side of psoas major m.
- * End: behind the mid-inguinal point, by entering the thigh to become femoral a.

* Branches:

- (1) deep circumflex iliac a.: passes laterally deep to inguinal lig. then along the inner lip of the iliac crest.
- (2) inf. epigastric a.: - it passes medially & upwards just med. to the deep inguinal ring then ascends inside the rectus sheath to anastomose with the sup. epigastric a. at the level of the umbilicus.
- it gives cremasteric a. & a pubic br. which may be large & replaces the obturator a.
& is called the abnormal obturator a. (see page 60).

Internal iliac artery

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Origin: opposite sacro-iliac joint as one of the 2 terminal brs. of C.I.A.

Course: descends downwards & backwards along lat. wall of the pelvis.

End: at the upper border of the greater sciatic foramen
by dividing into ant. & post. divisions.

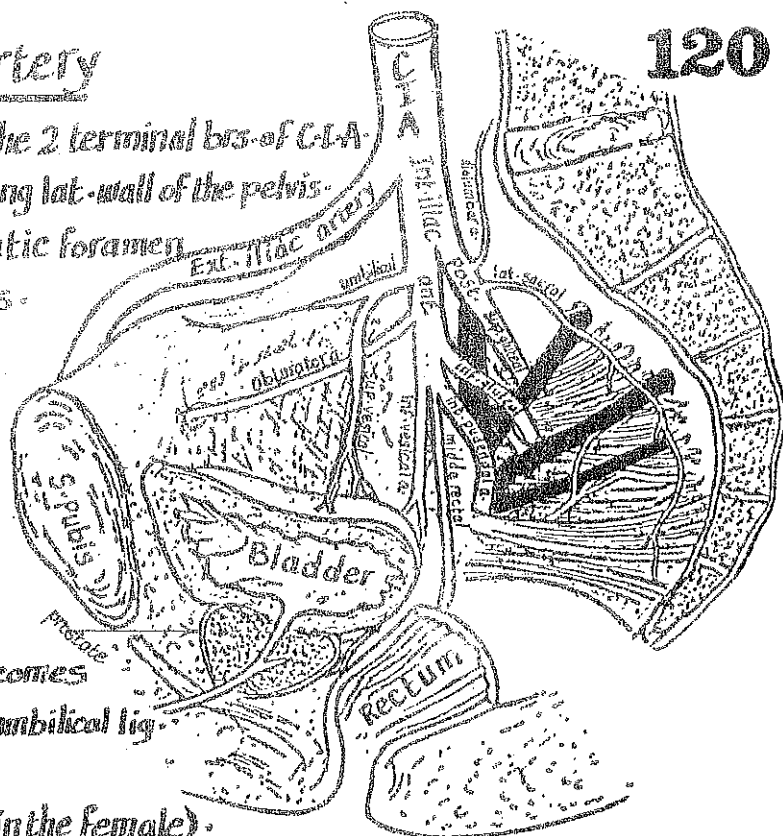
Branches:

(A) from the post. division:

- (1) iliolumbar a.
- (2) lat. sacral arteries (2).
- (3) sup. gluteal a.

(B) from the Ant. division:

- (1) umbilical a.: gives sup. vesical a. then becomes obliterated forming the lat. umbilical lig.
- (2) obturator a.
- (3) inf. vesical a. (replaced by vaginal a. in the female).
- (4) middle rectal a. (5) inf. gluteal a. (6) internal pudendal a. (7) uterine a. (in the female).



Inferior Vena Cava (I.V.C)

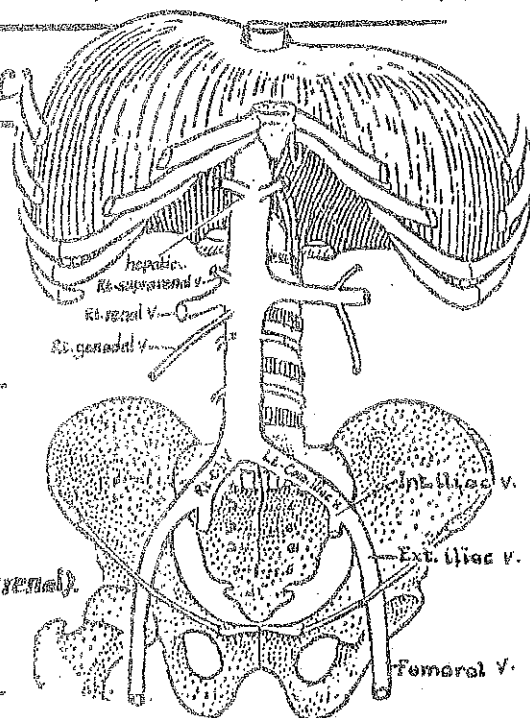
*** Beginning:** at lower border of L5 by union of the 2 common iliac veins.

*** End:** it pierces the central tendon of diaphragm to open into the Rt. atrium of the heart.

*** Course:** it ascends on the Rt. side of the abdominal aorta.

*** Tributaries:**

- (1) 2 Common iliac veins.
- (2) 2 pairs of lumbar veins (3rd & 4th of both sides).
- (3) 2 renal veins (4) 2 Rt-sided veins (Rt. gonadal & suprarenal).
- (5) 2 hepatic veins (6) 2 phrenic veins.



Anastomosis between S.V.C & I.V.C.

(A) In ant. abd. wall:

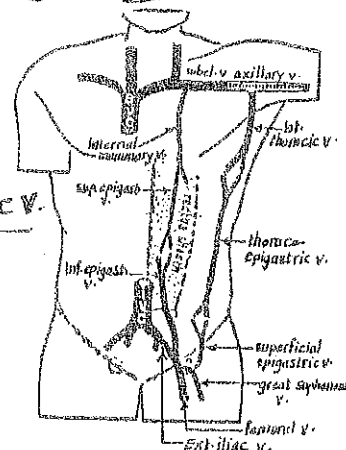
(1) Thoracoepigastric v. connects the lat. thoracic v. (of axillary v.) with superficial epigastric v. (of long saphenous v.)

(2) sup. epigastric v. (of int. mammary v.) anastomoses with inf. epigastric v. (of ext. iliac v.) inside the rectus sheath.

(B) In post. abd. wall:

(1) azygos v.: arises from the back of I.V.C & ends in the back of S.V.C

(2) the vertebral venous plexus connects the tributaries of I.V.C in abd. with tributaries of S.V.C in the thorax.



PERITONEUM

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* It is a large serous sac formed of 2 layers & a potential cavity:

(a) Parietal peritoneum: the outer layer which lines the abd. walls.
It is supplied by somatic nerves & sensitive to ordinary stimuli.
Its irritation leads to reflex spasm of the overlying muscles.

(b) Visceral peritoneum: the inner layer which covers abd. organs.
It is supplied by autonomic nerve fibres & sensitive only to stretch & ischaemia.

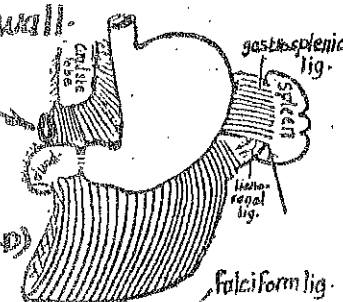
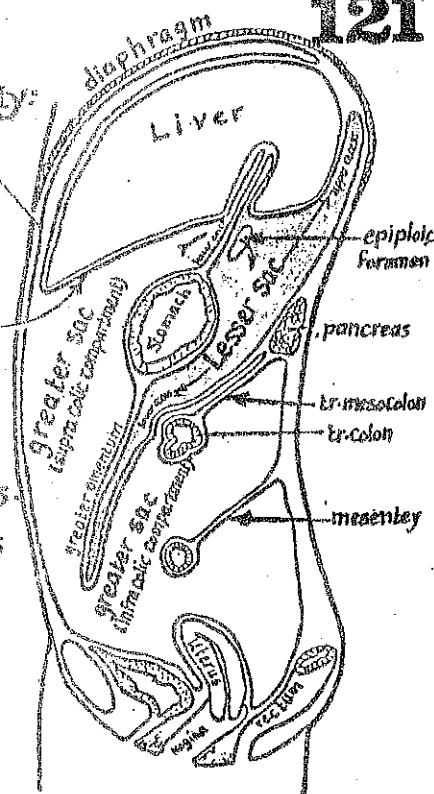
(c) the peritoneal cavity is the potential space between the 2 layers.
It contains a little amount of lubricating serous fluid which is increased in ascitis.

* The peritoneal cavity is subdivided into 2 sacs:

(a) lesser sac: is the space behind the lesser omentum & stomach & extends downwards inside the lesser omentum.

(b) Greater sac: the remaining larger part of peritoneal cavity which is opened by incising the parietal peritoneum of the ant. abd. wall.

* The greater sac communicates with the lesser sac via epiploic foramen which has the following boundaries: sup.: caudate process of liver, inf.: 1st. part of duodenum, post.: I.V.C on the post. abdominal wall, ant.: free margin of lesser omentum (containing hepatic a., portal v. & c.d.v.)



SUBPHRENIC SPACES

* These are potential spaces lying below the diaphragm & may become sites for collection of pus (subphrenic abscess).

* They include the following spaces:

(1) Rt. ant. subphrenic space: between Rt. lobe of liver & the diaphragm on the Rt. side of falciform lig.

(2) Lt. ant. subphrenic space: between Lt. lobe of liver & the diaphragm, on the Lt. side of falciform lig.

(3) Rt. post. subphrenic space (Morrison's pouch): between post. surface of Rt. lobe of liver, ant. surface of Rt. kidney & the lower layer of coronary lig. It is the most dependent part of peritoneal cavity in the supine position & is the commonest site for subphrenic abscess.

(4) Lt. post. subphrenic space (lesser sac of peritoneum): behind stomach & lesser omentum

(5) Rt. extra peritoneal subphrenic space: between bare area of liver & the diaphragm.

(6) Lt. extra peritoneal subphrenic space: around the Lt. suprarenal gland & upper pole of Lt. kidney.

